

CANADIAN MACHINERY

AND MANUFACTURING NEWS

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UNIVERSAL
PLATE

to 40" Wide

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to 60" Wide

ANY THICKNESS - ANY LENGTH

Analysis and physical
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Hamilton Ontario

You Need a Good Die Stock Set

if you need one at all.

Because a **GOOD** Die Stock Set embodies:

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2. Adjustment for wear.
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BETTER than most because of the interchangeable feature in their chasers. A broken chaser in a P. & W. Die doesn't mean a new set of chasers. You can get a new chaser to replace a breakage and the new one "fits in" perfectly in your old set. That's the 6th point, "**ECONOMY IN OPERATION.**"

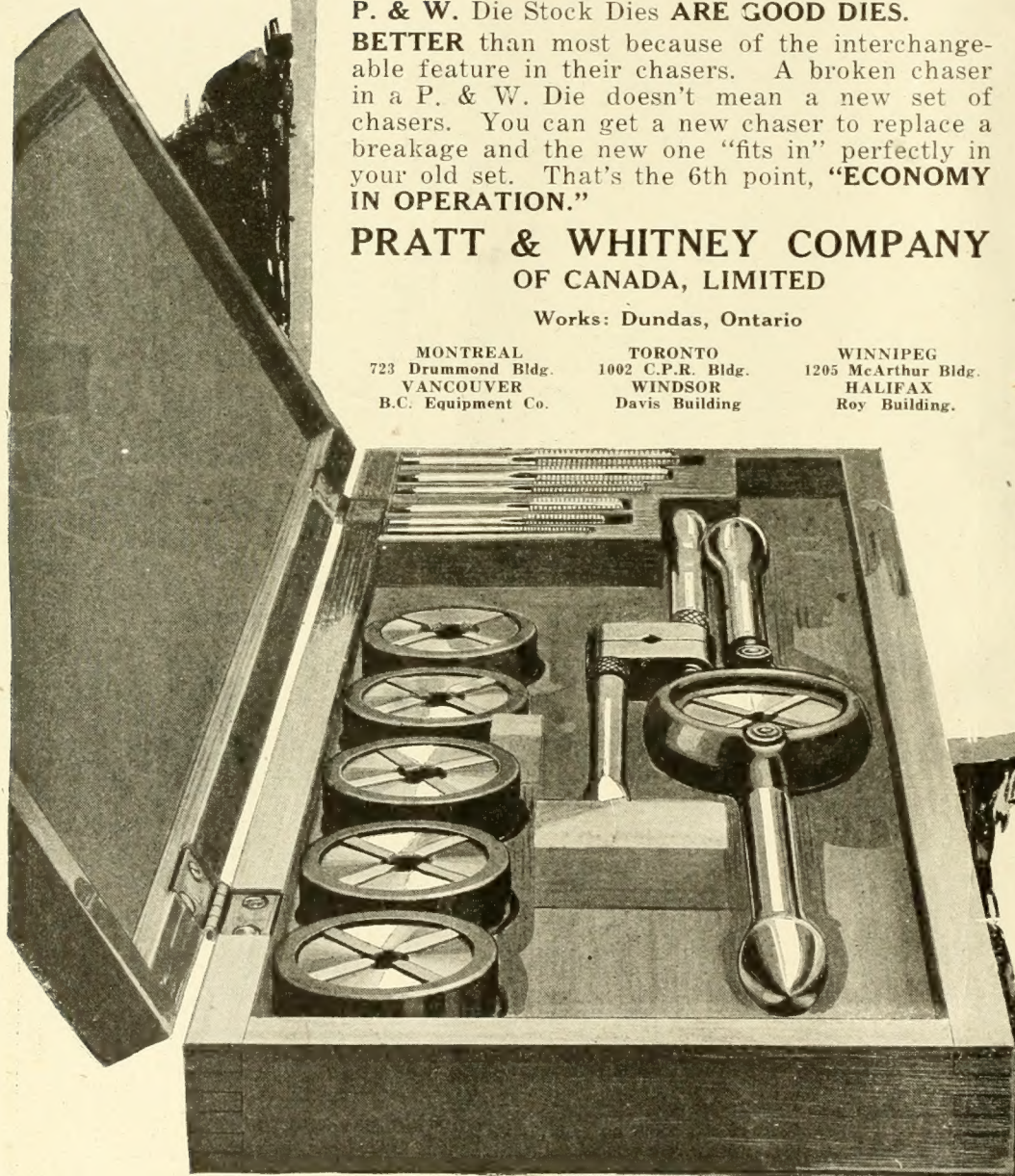
**PRATT & WHITNEY COMPANY
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PRATT & WHITNEY

The BERTRAM MACHINE TOOLS Page



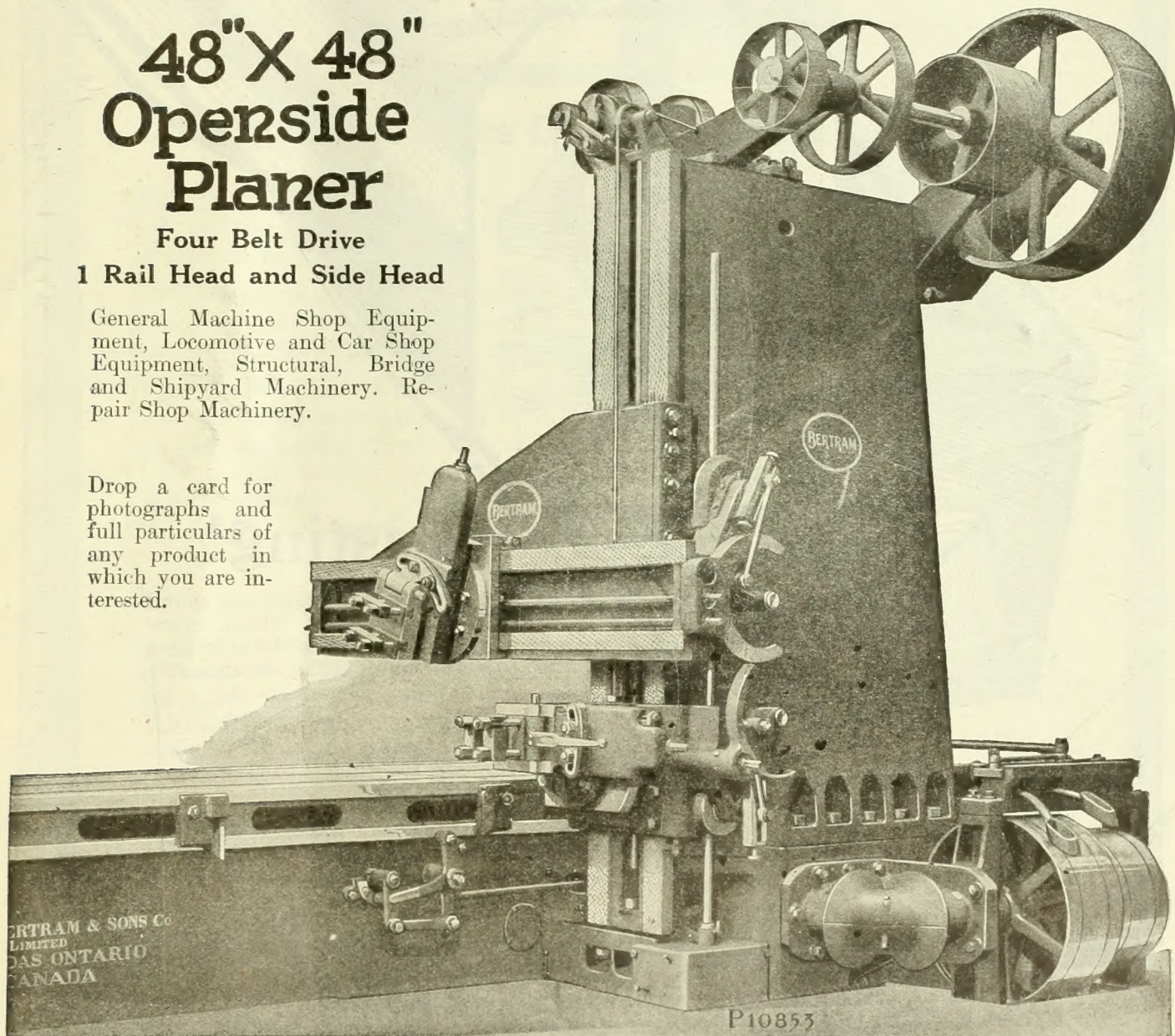
48" X 48" Openside Planer

Four Belt Drive

1 Rail Head and Side Head

General Machine Shop Equipment, Locomotive and Car Shop Equipment, Structural, Bridge and Shipyard Machinery. Repair Shop Machinery.

Drop a card for photographs and full particulars of any product in which you are interested.



BERTRAM & SONS CO.
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CANADA

P10853

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IMCO TOOLS



Lasting!

Consider the time your men spend over the grinding wheel every day. Isn't it a considerable item toward your cutting expenses?

The ability of "Imco" Tools to hold a keen edge for unusually long periods is one of the primary reasons for their growing popularity.

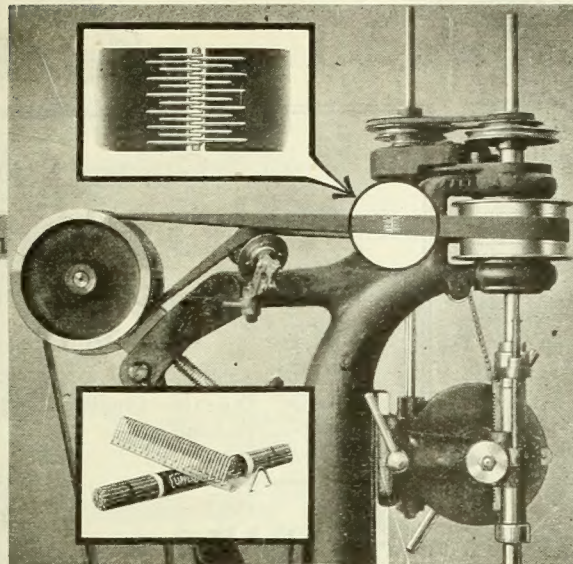
Catalog of "Imco" 3 and 4-lip drills, reamers and milling cutters upon request.

Ingersoll Machine & Tool Co., Ltd.

Ingersoll, Ontario.

Toronto Office — 80 Bay St. Phone Adelaide 7227.

Chas. A. Strelinger Co. Ltd. Windsor, Ont.



The "Clipper" Solves Difficult Lacing Problems

THE difficulties encountered in using *quarter-turn drives* can be overcome by installing an idler *set at the proper angle* to direct the line of belt travel as shown above.

Before the installation of the idler this was a plain quarter-turn drive. The machine was a veritable "Belt Eater." No endless or laced belt could stand the strain. Belt expense was excessive.

By the use of an idler much greater pulley contact was obtained, horse-power was increased materially and all injurious side-strain eliminated. Since with an idler both sides of belt come in pulley contact, it was necessary to use a laced joint *smooth on both sides*. "Clipper"-laced Belts are now lasting as long as on straight drives.

The Clipper Belt Lacer Laces a Belt in Three Minutes

It makes the smoothest possible joint, with a perfect hinge action that hugs the pulley and runs true. The "Clipper" Belt Lacer is so simple that any workman can successfully lace a belt with it. It is backed by a perpetual guarantee and goes to responsible parties for free trial.

*Most mill supply houses sell the "Clipper."
Dealers not stocking it write for particulars.*

"The Connecting Link Between Power and Production"



Clipper Belt Lacer Company

GRAND RAPIDS, MICHIGAN, U. S. A.



Open Hearth Alloy Steels

Chrome-Vanadium

Chrome-Nickel

Nickel

All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.

Sulphuric Acid

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STEEL RAILS

Open Hearth Quality
(All Sections from 12 lbs.
to 100 lbs. per yard)

SPLICE BARS

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FIG IRON BASIC, FOUNDRY MALLEABLE

SULPHATE OF AMMONIA

BLOOMS BILLETS SLABS

STRUCTURAL STEEL

MERCHANT BARS

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Your enquiries and business will be appreciated.

ALGOMA

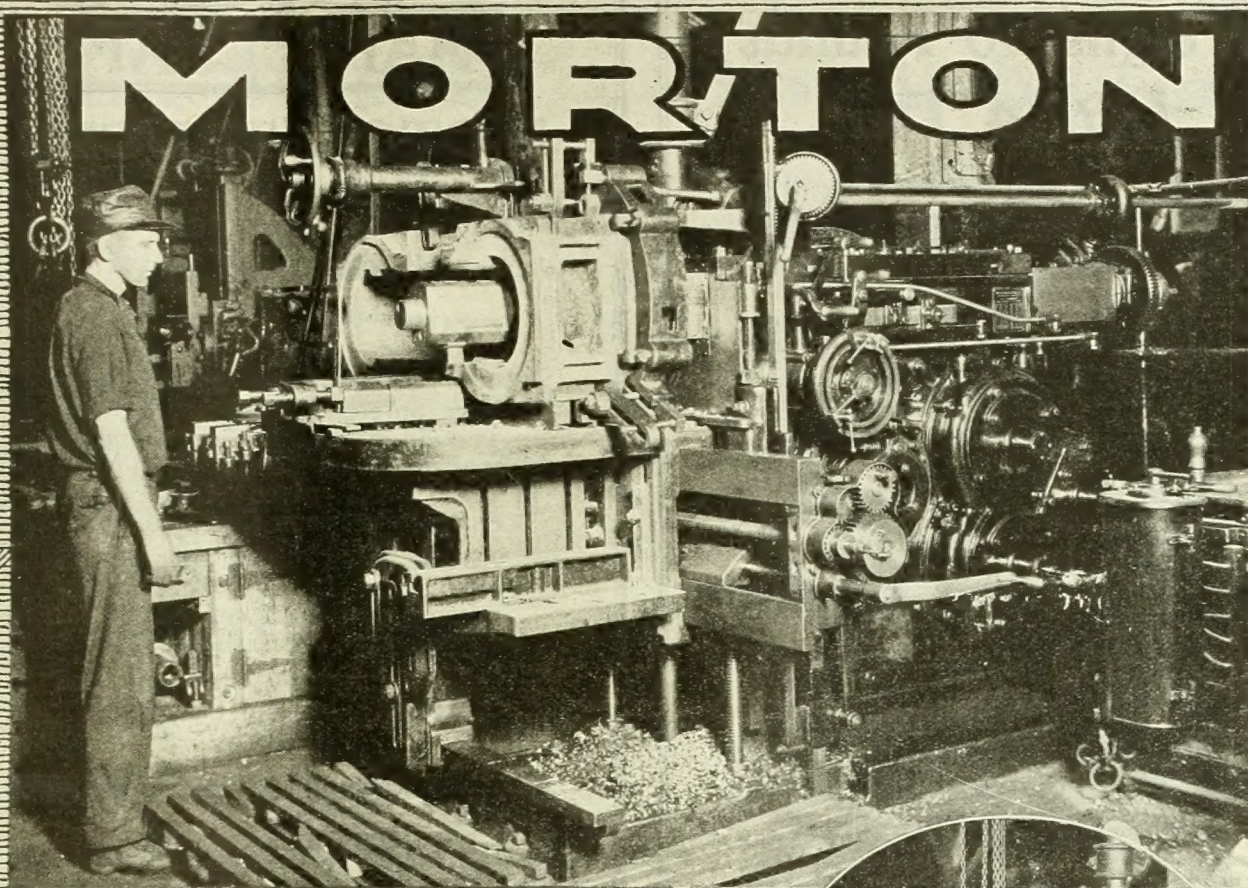
STEEL
CORPORATION
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SAULT STE. MARIE, ONTARIO

Sales Offices:

MONTREAL -606 McGill Bldg.

TORONTO -Bank of
Hamilton Building



Increased Driving Box Repairs Forced the Purchase of this Morton Draw Cut Shaper

Delays to output were traced direct to driving box repairs in this busy shop. Time element and shortage of man power were considered and the installation of this "Morton" reflects the good judgment of these thoughtful officials to install machines of guaranteed production power.

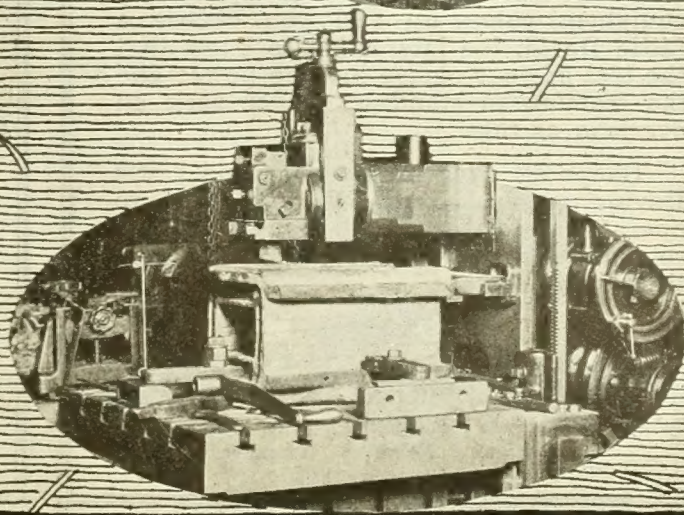
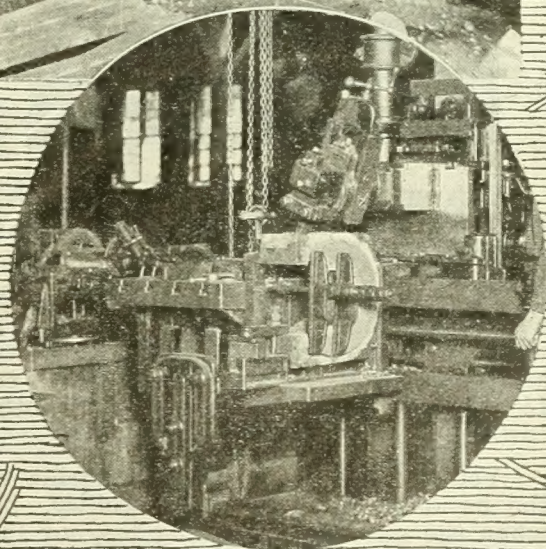
This Morton handles all the machine work on driving boxes—planing to thickness, planing shoe and wedge faces and crowning for bearing brass. It simplifies handling and reduces machine time.

May we send Bulletin A-6 explaining numerous points of merit?

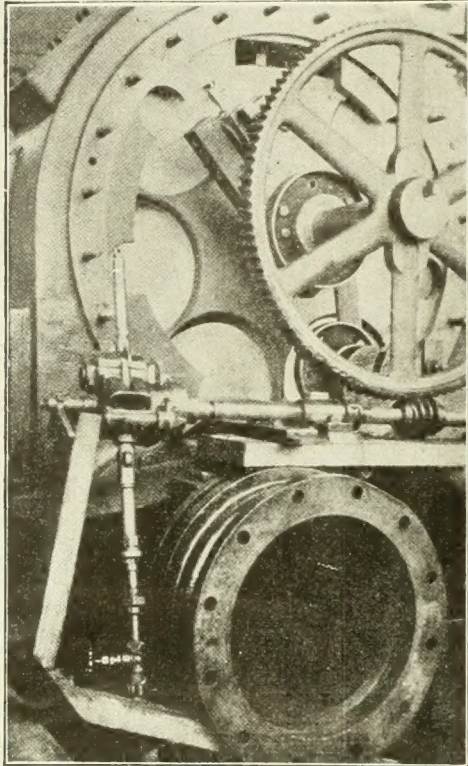
MORTON MFG. CO.

Muskegon Heights

Michigan



Weights 40 Pounds Lifts 4 Tons



This cut illustrates a No. 2 Little David Drill reboring a 40-inch air compressor cylinder at a large Ontario mine.

Speaking of the power of this drill, the master mechanic said: "The cylinder weighed in the neighborhood of four tons, and at times, if the boring tool stuck, the Little David Drill would lift the entire casting enough to be noticeable."

You do not buy pneumatic drills on the basis of their hoisting ability, but when the question of adding to your tool equipment comes up and you choose a Little David, it's interesting to know that the tool of your choice has the power and the stamina to stand up under such an overload as this.

Shops all over the country find Little Davids rugged, highly efficient, easy to operate, and readily portable. Ask for a set of Little David bulletins. You'll find them of interest.

**Canadian Ingersoll-Rand Company,
LIMITED**

Sydney	Sherbrooke	Montreal	Toronto	Cobalt
	Winnipeg	Nelson	Vancouver	



MOTOR TRUCKS

*Winning an Argument
with a Wicked Hill*

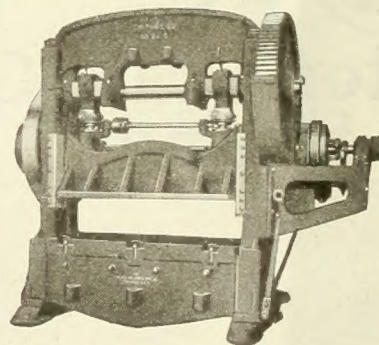
THAT'S when the driver of a Mapleleaf wears a smile. For Mapleleaf transmissions have ample multiplying power. The 5-ton model, for example, multiplies six times on lowest speed and gives two other changes between that and high.

All the gears change quietly and effectively. The whole transmission system is of the most rugged type imaginable.

Let us show you the Mapleleaf in action.

**Mapleleaf Manufacturing Company
LIMITED
MONTREAL - CANADA**

The "TOLEDO" Double Crank Presses



Unequalled for rigid strength, durability and low upkeep in addition to their widely recognized speed and accuracy of performance.

Over 200 sizes weighing from 4,500 to 500,000 pounds—straight-side and gap or overhanging frame types.

Adapted to general sheet metal and drop-forged work.

We fit the press to the needs.

**The Toledo Machine & Tool Co.
Toledo, Ohio, U.S.A.**

ELK BRANDS FIRE BRICK

*Sizes and Burns
Kept Uniform*

Each batch of fire brick as finished is carefully sorted into two, three or four different classes of burns—burn refers to the degree of hardness to which the fire brick is burned. We have OVER-BURNS, HARD, MEDIUM HARD, and MEDIUM. All burns have their place; we should know where and how the brick is to be used in order to furnish the best for the purpose.

Let us work with you and you will secure from Elk Brand the results you hope for.

"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"

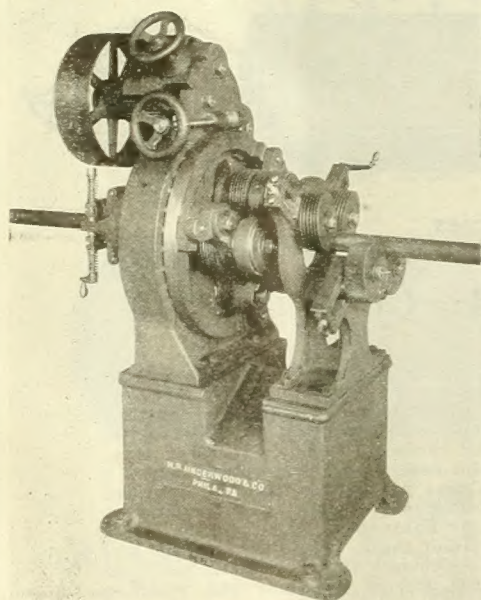
"Keystone"
"M.D. Elk"
"Rotex"

"Elk Dust"
"Keystone Dust"
"Rotex Dust"

Large stock of various shapes always in stock
at Hamilton Warehouse.

**ELK FIRE BRICK CO. OF CANADA
LIMITED**

Sun Life Building, HAMILTON, ONTARIO



No. 1
1½ to 3"
Flues

No. 2
3 to 6"
Flues

Rotary Flue Cleaning Machine

Built in 2 sizes

This strong, easily operated machine is unequalled for removing scale or crust from boiler flues. It requires very little power and will clean from eight to ten feet per minute. It completely removes all scale without injury to the flue. Write for full particulars, and list of other Underwood Machines.

H. B. UNDERWOOD CORPORATION

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Now is the Time

to babbitt one or
more bearings
with

Lionroyal

to test
the length of wear
it gives over other babbitts.



In normal times
you claim you're
too busy to
experiment.

You say to us
"Wait until
business slacks
a bit—then we'll try it."

Now is the time!

You want to cut costs
and get full value
for every dollar.

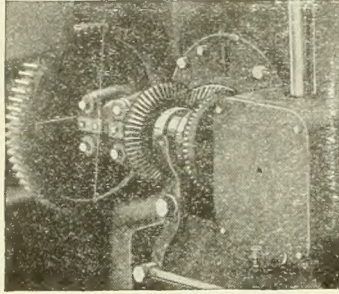
Longer Wear per Bearing
that is our guarantee!
You have the time,
therefore

Write for a trial case, 28 lb.,
56 lb., or 112 lb. size.

**BRITISH
SMELTING & REFINING
COMPANY LIMITED**
MONTREAL

THE JOHNSON FRICTION CLUTCH

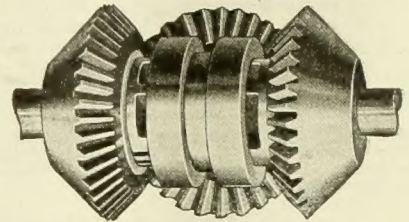
Clutches for Reversing Functions



Johnson Clutch Installation on a
Newton Milling Machine

A reversing clutch is a very common requirement on machinery, and one which is encountered in many different forms. Whatever the situation may be, a Johnson Clutch offers the best method of handling it.

The bevel gear assembly shown here is one of the ways in which a Johnson Double Clutch is frequently applied for reversing functions. Many of the best machine tools are equipped in this manner.



Double Clutch in Nest of Bevel Gears

Write for our Yellow Catalog and Booklet,
"Clutches As Applied To Machine Building."

CANADIAN AGENTS:

WILLIAMS & WILSON, LIMITED, 84 Inspector Street, Montreal
CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



New Truths and Old Fallacies

Hardness of Alloys—Continued

The differences in the measurements of the sustaining powers, under pressure, between tin-base copper hardened metals, and lead base metals, free of copper, as shown by tests by the American Society for Testing Materials, is so slight that in some cases it is not more than the breadth of a hair.

In a test, made for us some years ago, Magnolia withstood 19 per cent. greater stress than a Genuine. This test loses some value because we do not know the brand or formula of the Genuine.

In 1912, Professor Robert H. Smith, an eminent mechanical engineer and authority, tested Magnolia against an imitation. In this case Magnolia withstood 16,980 pounds (7½ long tons) per square inch pressure before the test block collapsed. When it is considered that this was a small cylindrical shaped test block, unsupported on the sides to prevent spreading, it is evident how much heavier a strain Magnolia will bear without distortion, when supported in recesses of a shell, and what a large factor of safety it provides.

For copy of complete article:
"New Truths and Old Fallacies"
Address our Montreal Office

Professor John Goodman, an equally eminent mechanical engineer and authority, says of Magnolia: "My experience distinctly shows that the higher the pressure applied to a Magnolia Bearing, the better does the wearing surface become." He also says: "I ran a Magnolia bearing for some weeks under a pressure of two tons per square inch, at a surface velocity of 250 feet per minute; the temperature maintained at 130° Fahrenheit, by circulating water through the center of shaft. After the run the surface was perfect, although the lubrication had been meager, viz: 0.002 lbs. of oil on a pad weighing 0.002 lbs."

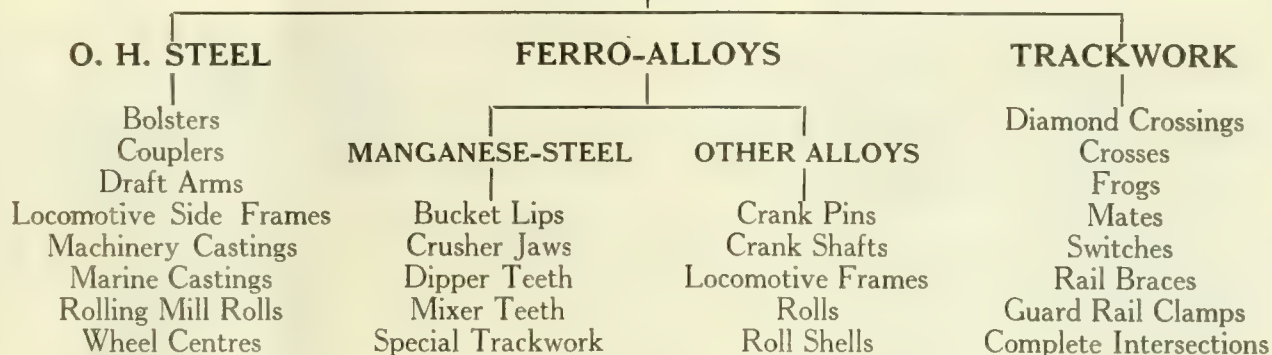
(Continued next month)

Sold by Leading Dealers Everywhere or by
Magnolia Metal Co. of Canada
Limited

Office and Factory:
37-39 Shannon Street, Montreal, Que.

CANADIAN STEEL FOUNDRIES LIMITED

AMONG OUR PRODUCTS

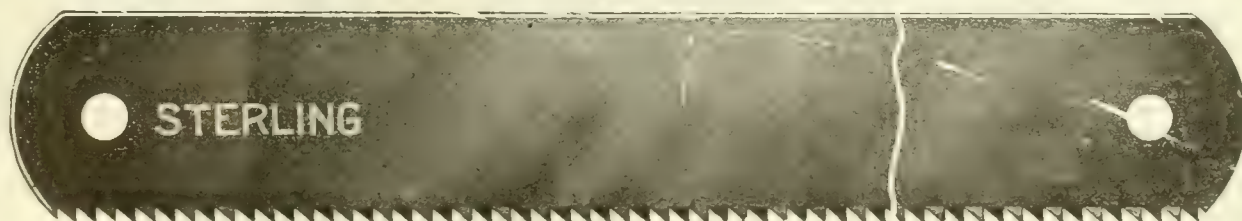


This list is merely an indication

General Offices:

Transportation Building, Montreal

"STERLING" HACK SAW BLADES



A brand once adopted, difficult to replace.

REASONS—High quality of material used, mechanical construction, and special heat treatment.

RESULTS—Economy, which means satisfied customers.

Write for Information and Prices

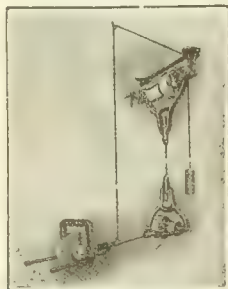
DIAMOND SAW & STAMPING WORKS
BUFFALO, N.Y., U.S.A.

FORD-SMITH

We Are Ready to Anticipate Your Needs for All Kinds of—
SPECIAL MACHINERY

and Dies, Jobbing Work, etc.

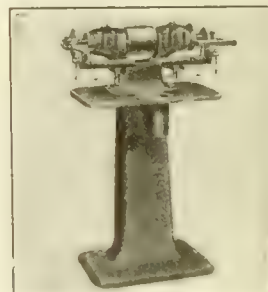
Expert machinists of long experience only are employed in the construction of our special machines in addition to those employed on



OUR REGULAR LINES OF

Milling Machines, Motor Driven and
 Belt Driven Grinders, Polishers, Disc
 Grinders, Swing Grinders.

*Our Engineering Staff is always ready to submit estimates
 and answer problems. Write us to-day.*



THE FORD-SMITH MACHINE CO., Ltd.
HAMILTON, CANADA

Foreign Agents: W. E. Storey, 3 Arundel St., London, Eng.; Gollin & Co., Melbourne, Australia; Ateliers Demoor, Brussels, Belgium.

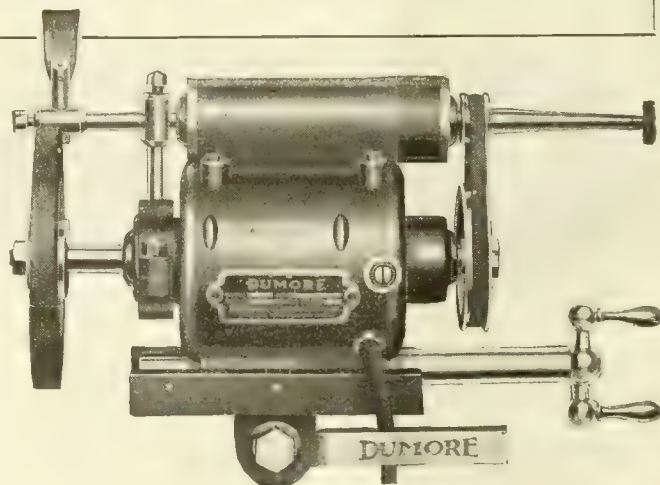
A Good Example of What Can Be Done With **DIE-CASTINGS**

The popular grinding machine herewith illustrated is a good example of what can be accomplished by the Die-Casting process. The parts of this machine are die-cast, which represents a big saving in time and expense over any other method of construction.

The Die-Cast parts used in this grinder required no machining. They were delivered in perfect condition, ready to assemble. This is the big feature of all die-cast parts. They are accurate, and smooth in finish.

Die-Cast parts can be profitably used for many purposes. Send us your blue prints or samples for estimates.

Largest makers of Die-Castings in Canada.



THE FISHER MOTOR CO., LIMITED
ORILLIA, ONTARIO



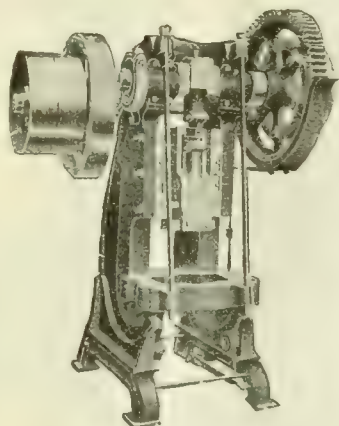
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



BROWN-BOGGS



B B



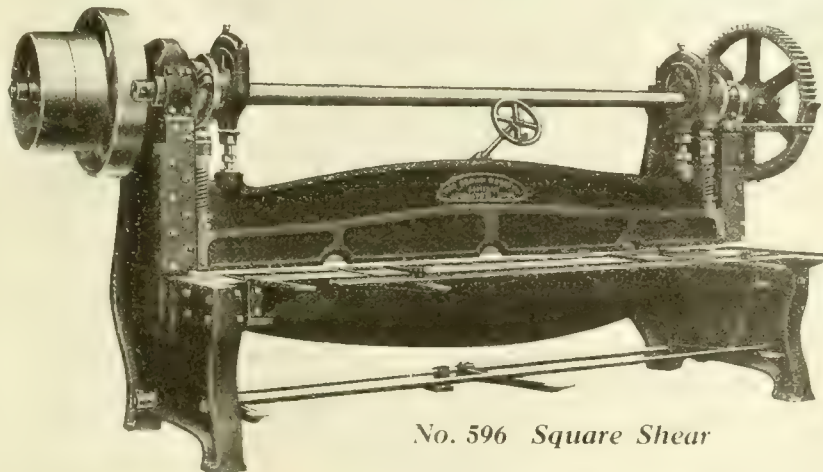
No. 215--Power Press

The Sheet Metal Workers' Tools shown here are typical examples of B.B. quality and mechanical excellence. Make sure of the Brown-Boggs trade mark—it's a guarantee of reliable service.



No. 36—Ring and Circular Shear

WHEN you buy machinery, choose that which has a reputation for giving long, satisfactory service. Every Brown-Boggs product is manufactured from the highest quality materials, by thoroughly competent workmen, in a fully equipped modern plant.



No. 596 Square Shear

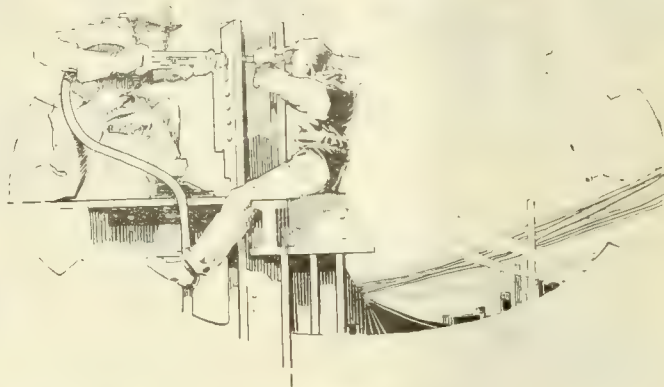
The "B.B." line comprises tinsmiths' tools and sheet metal working machines of every description; canners' and evaporators' machinery, shears of all kinds, power presses for punching, forming, embossing, blanking, etc.

Write for complete catalogue.



THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.



The Dependable Character of Dominion Rubber Hose

is the result of its ability to meet exacting conditions. There are two principal reasons why Dominion Rubber System Hose is used by most Canadian industries—first, because of its performance, and second, because our factory keeps abreast of industry's most exacting demands.

Dominion Rubber System Hose

is designed for every requirement—for conveying liquids, gases, oils, acids, air or steam, at practically any temperature or pressure. When new conditions crop up, we produce special types to meet them. The fact that we do create new types for the Canadian market is evidence that Dominion Rubber System Hose measures up to the requirements of Canada's largest hose users.

Our catalog is a useful and convenient reference in selecting the right type of hose for your particular needs. A copy will be sent free on request from our nearest service branch.



Our Dominion Belting, Packing and Industrial Rubber Goods are all the same High Standard as Dominion Hose.

Dominion Rubber System Service Branches

Halifax	Toronto	Fort William	Edmonton
St. John	Hamilton	Winnipeg	Calgary
Quebec	London	Brandon	Lethbridge
Montreal	Kitchener	Regina	Vancouver
Ottawa	North Bay	Saskatoon	Victoria

Belting

Transmission: "Dominion," "Keewatin," "Para."
Conveyor: "Rockproof," "Canadian," "Hiheat"
Elevator: "Dominion," "Rockproof."
Agricultural: "Dominion," "Star."
Grain Elevator: "Metcalf Standard," "Grain King."

Hose

Air: "Kushion Kover," "4810 Airtite," "Star."
Steam: "Indestructible," "Rockproof," "Para."
Water: "Indestructible," "Para," "Kushion Kover," "Star."
Suction: "Para," "Star," "Trade."
Garden: "Canadian," "Dominion," "Star."

Packing

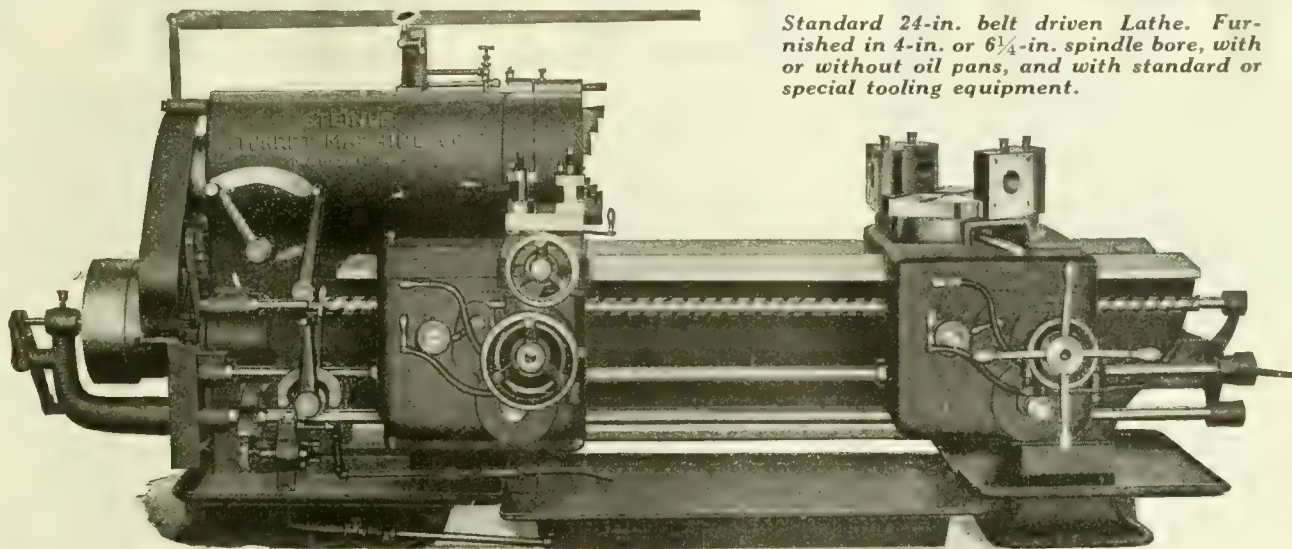
Sheet: "Join-Tite," "Star," "Importers."
Rod: "Cabestos," "Valve-Bestos," "Canadian."
Valves: "Montreal," "Commercial," "Canadian."

Miscellaneous

Mats, Matting and Flooring, Plumbers' Specialties, Rubber-Covered Rolls, Friction Tape, Splicing Compound, Dredging Sleeves, Hard Rubber Goods, Tubing, Rinex Soles, Catspaw Heels, Jar Rings, Moulded Goods.

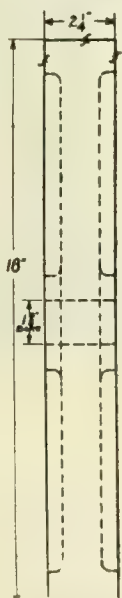
STEINLE

Full Swing Side Carriage Turret Lathes



Standard 24-in. belt driven Lathe. Furnished in 4-in. or 6¼-in. spindle bore, with or without oil pans, and with standard or special tooling equipment.

TIME—Floor to Floor—4½ Minutes Each



THE MACHINE was a standard 24-in. Steinle Turret Lathe with 4-in. spindle bore arranged for belt drive, and equipped on turret with boring bars and special overhead bar carrying a turning tool and on cross slide carriage with a special three-cutter tool block.

THE WORK was an 18-in. cast iron gas engine flywheel. The surfaces machined included boring hub with bars, rough turning rim with special overhead bar carrying turning tool, and shaving and facing both sides of rim with a three-cutter tool block on cross slide carriage.

Just one more record of rapid production on a machine designed and built for fast severe service in producing accurate work economically.

And this record is maintained not on one or two pieces, but on lots of several hundred—just steady, consistent production under average shop conditions.

Do your records compare with this?

Why not send us your blueprints and let our Engineering Department determine what can be done on your own work, or ask to have a qualified representative call and go thoroughly into the matter?

STEINLE TURRET MACHINE CO.

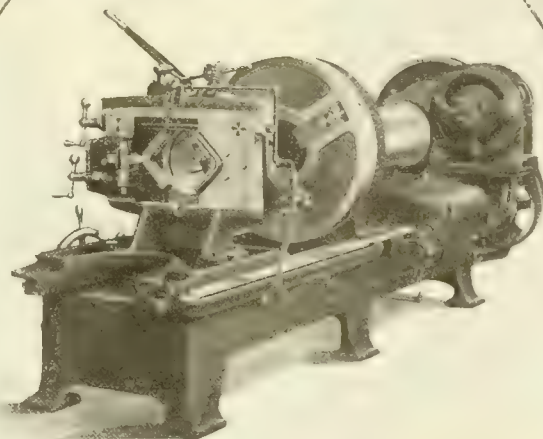
Originators of the Full Swing Side Carriage Turret Lathe

Madison, Wisconsin, U.S.A.

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Fran-

cisco, California, and Title Insurance Building, Los Angeles, California. Foreign—Leo. C. Steinle, 53 Victoria Street, London, England.

WILLIAMS



PIPE MACHINES

Outstanding Features:

- | | |
|---|---|
| 1—Single Pulley Drive, through. | 6—Individual Adjustment for each bearing. |
| 2—Dodge Friction Clutch, on machine. | 7—Large Spindle Bearings are ring oiling. |
| 3—Clutch Lever at operator's left hand. | 8—Compact Control Levers on operator's side. |
| 4—Rigid Bearing Bracket on drive shaft. | 9—Large Die Cabinet and Tool Tray. |
| 5—Gear Box Drive away from operator. | 10—Substantial Oil Trough around top of ways. |
| 11—Specially constructed Reservoir and Filterer. | |
| 12—Low-down Sliding Head. | |
| 13—Rotary Geared Pump reversible for left-hand thread. | |
| 14—Specially designed Carriage to drain off oil and cuttings. | |
| 15—All Gears amply protected. | |

*Send for Catalog of
Various Styles*

WILLIAMS TOOL CORPORATION
of Canada, Limited - Brantford, Ontario

Successors to
JOHN H. HALL & SONS, LIMITED

The Sign of Efficiency

MORSE DRIVES

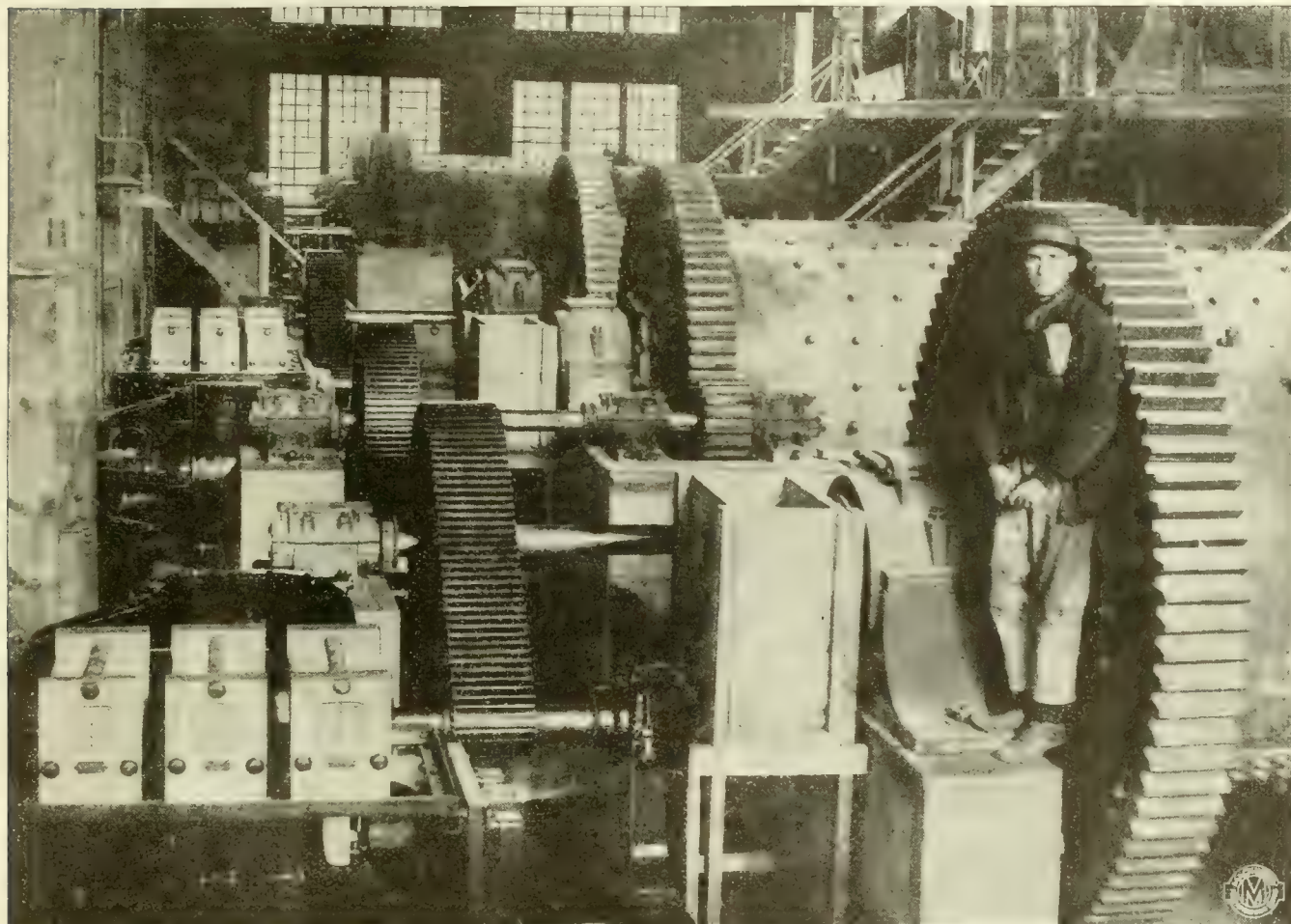
The Sign of Durability

Positive as Gears

Flexible as a Belt

Longer Life

THE MORSE "ROCKER JOINT"



Six in Sight—More on Another Floor

MORSE Rocker Joint Silent Chain Drives installed about a year ago in plant of Canada Copper Corporation Ltd., Allenby, British Columbia, in severe service, transmitting 99% efficiency from 100 H. P. motors to 5' x 20' Tube Mills.

Have you troublesome drives in Hard Service in Dust, Gases or Steam? Let us show you how to save fuel.

increase production, lower maintenance costs and bring out the profits lost through slipping belts.

Our Sales Engineers are Power Transmission Experts, who make it their business to secure results, that are the best available for your Power Problem.

Consult us on heavy, difficult or expensive drives.

MORSE CHAIN CO.,

Morse Engineering Service

LARGEST MANUFACTURERS OF
SILENT CHAINS IN THE WORLD

ITHACA, N. Y.

Assistance Without Obligation

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ST. LOUIS, MO., Chemical Bldg. Morse Engineering Co.



"Morse" is the Guarantee Always Behind the Efficiency, Durability and Service

NO. 1

Every time you neglect to wear your goggles you become a candidate for a steady job holding a tin cup and wearing a "Please Help the Blind" sign. Wear your goggles!

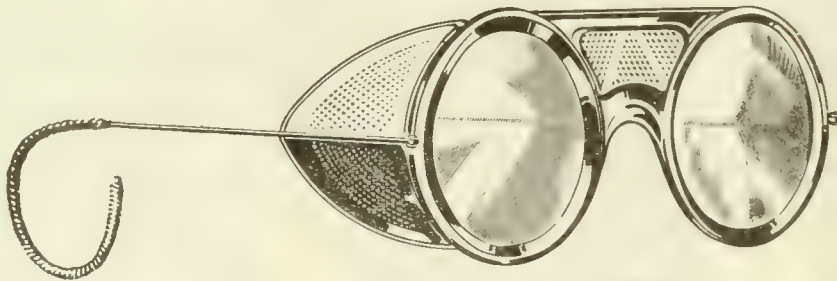
This is No. 1 of a series of short pointed paragraphs which will appear regularly in our advertising in the future. Permission is freely given Safety Engineers, Editors of Employees' Magazines and others to use this material as they wish. In addition, we shall be glad to furnish these paragraphs in leaflet form, in any quantity, for insertion in pay envelopes.

STOCO SAFETY GOGGLES

(Pat. Dec. 12, 1916)

with

"CELOGLAS" Shatter-Proof Lenses



Comfortable-Protective-Durable

Every operation on the **Stoco** Safety Goggle is performed entirely within our factory—by an organization with thirty odd years of experience in building a varied line of optical ware for a most exacting trade.

And because we do actually manufacture it, we must stand four square behind the **Stoco** Safety Goggle. We alone are responsible for its satisfactory performance. If it falls down there is no one to whom we can pass the buck.

The **Stoco** Safety Goggle
Price Each (F. O. B. Geneva, N. Y.)

With Celoglas Shatter-Proof Lenses.....	\$1.15
With Optical Glass Lenses .....	.90

Attractive Discounts for Quantity Orders.

Comfortable earbows or black elastic headbands at the same price.

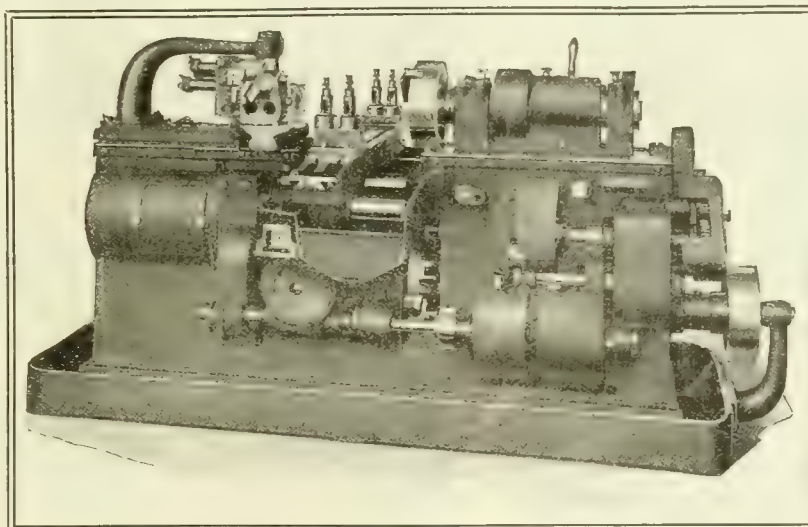
A sample **Stoco** Safety Goggle will be sent interested responsible people on receipt of request on letterhead.

THE STANDARD OPTICAL CO.

GENEVA, N.Y. U.S.A.

AUTOMATICS

Let the P. & J. Automatics shoulder the responsibility. They solve the high cost of operation. They keep production up to the highest notch and bend the cost down to the lowest point on your chart.



Five to fifteen cutting tools may be in simultaneous operation. And three to six machines may be operated at one time by one man. All the one man does is to keep the machine fed up with enough work. The P. & J. method has displaced previously believed "unbeatable" methods a number of times.

We will be glad to let you know what economy the P. & J. can effect for you.

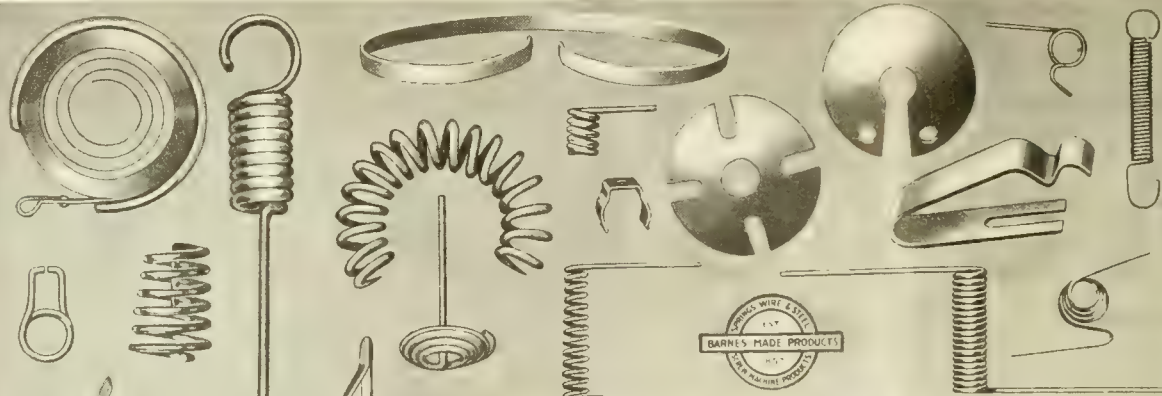
Simply send us an outline of your work.

Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office and Show Rooms:

11 Wellington Street East, TORONTO, CANADA



Not—What We *Do* But—What We *Don't*

Because this Company designs and manufactures springs in thousands of types and sizes—for hundreds of thousands of purposes—we propose to take a “short cut” in telling you about it.

You can count on the fingers of one hand the types of springs we do **not** make. They are the following:

Upholstery Springs

Suspension Leaf Springs

—and that's *ALL!*

If the springs that go into your product are not one of these types, remember this —“Barnes-Made” Springs are made to order, of our own specially tempered material. They are always in conformity with the requirements of your product—or according to your own detailed specifications. Three generations' experience stands back of every “Barnes-Made” product. Accuracy and dependability are guaranteed.

THE WALLACE BARNES
Company

“Spring Makers for Three Generations”

Main Office and Works:
BRISTOL, CONN.

Western Sales Office:
BOOK BLDG., DETROIT

Springs of steel, brass, phosphor bronze or vanadium flat coiled spiral compression, extension or torsion. Wire Forming, Spring Washers, Small Parts of steel, brass, etc. in any finish. Assemblies. High Carbon Cold Rolled Steel.

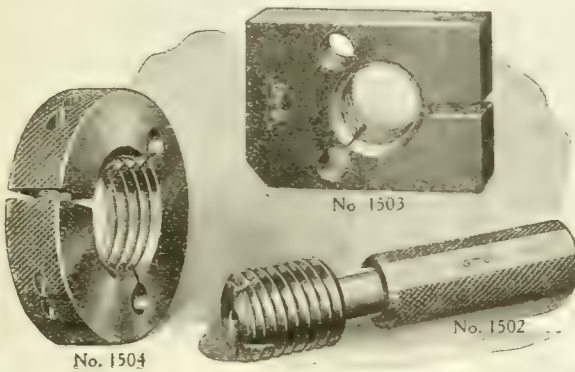
Look for  This Mark



GTD Pipe Wrench



No. 5 *Little Giant* Screw Plate



GTD Male and Female Thread Gages

GTD Hand Reamer



Taps and Dies

For hand and machine use, including the Shear-Cutting "**Gun**" Tap and the "**Acorn**" Die.

"**Gun**" Tap



Gages

Thread limit snap—lead limit, plug and templet. Both thread and cylindrical.

Reamers

For every purpose, accurate and hard-wearing.

Pipe Tools

Pipe Wrenches, Vises, Cutters, Taps and Dies.

Screw Plates

The famous *Little Giant* and "OK" brands. An assortment for every screw-threading need.



Successors to
WELLS BROS. CO. OF CANADA, Limited
London Office: 139 Queen Victoria Street, E.C. 4

Clip this coupon
and send it in

G.T.D.
Corporation of
Canada, Ltd.,
Galt, Ontario.

Please send me catalogs descriptive of the following:

☐ Small Tools ☐ Pipe Tools
☐ Gages

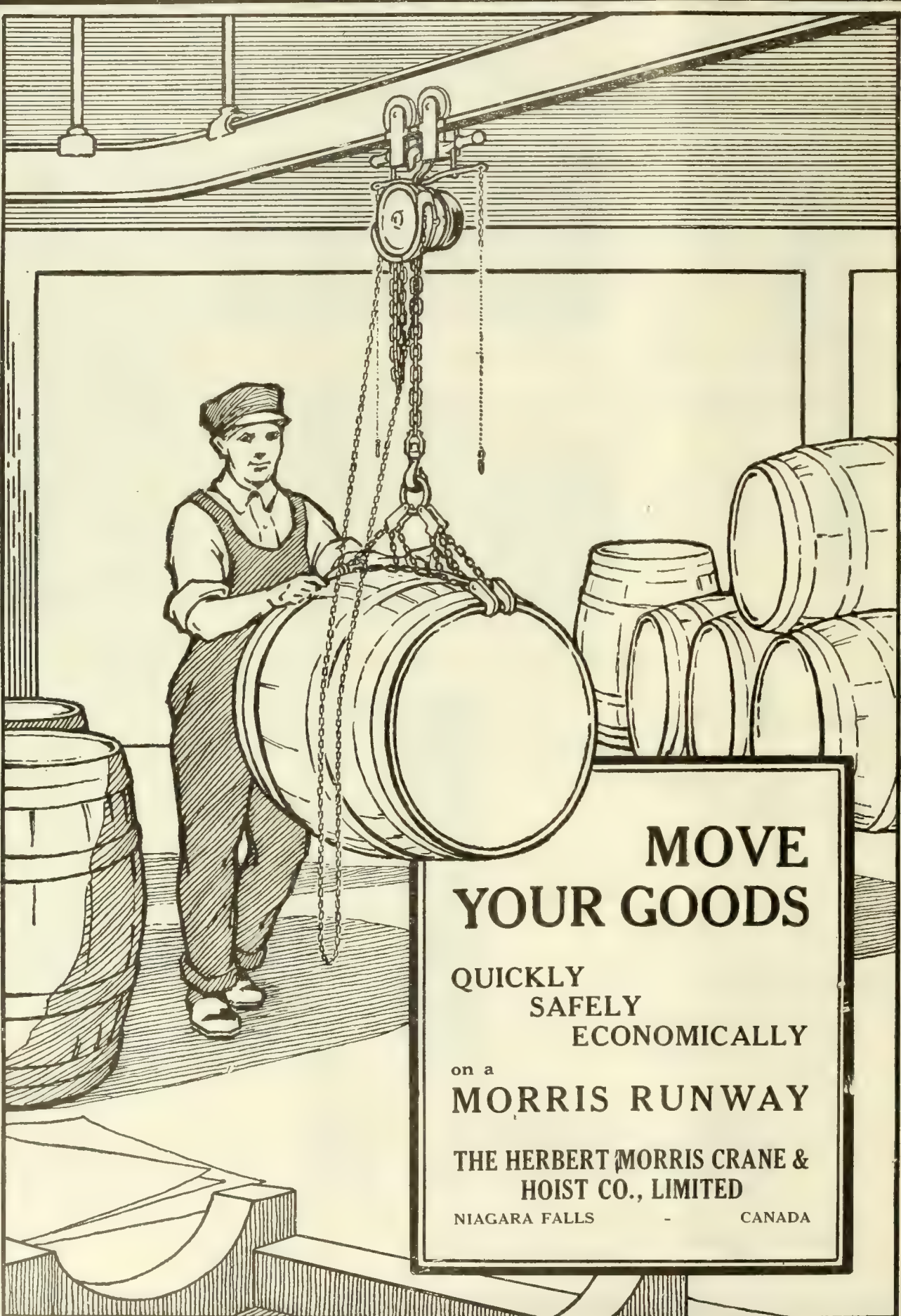
Name

Position

Firm

Address CM 202

If interested tear out this page and place with letters to be answered.



The illustration shows a man in a cap and overalls standing in a warehouse, operating a Morris Runway crane. The crane is a trolley-mounted system with a pulley and chain hoist, lifting a large wooden barrel. Several other barrels are stacked in the background. The scene is set in a large industrial building with a high ceiling and structural beams.

**MOVE
YOUR GOODS**

**QUICKLY
SAFELY
ECONOMICALLY**

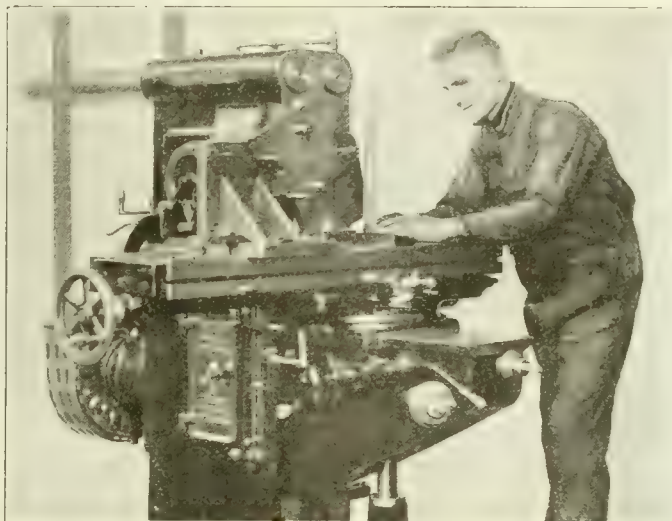
on a
MORRIS RUNWAY

**THE HERBERT MORRIS CRANE &
HOIST CO., LIMITED**

NIAGARA FALLS - CANADA

MILWAUKEE MILLING MACHINES

KEARNEY & TRECKER CO.
MILWAUKEE
MILLING
MACHINES



Efficient on Light and Heavy Milling

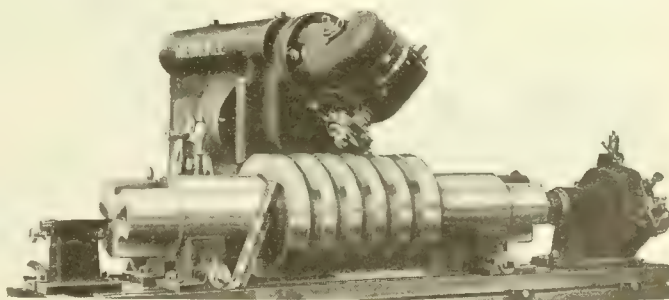
Heavy milling jobs are not unknown to Milwaukee Universal Milling Machines, while delicate and intricate ones are efficiently performed with little effort.

Both light and heavy milling operations are handled with such smoothness and accuracy that the finest results are obtained. Because Milwaukee Universal Milling Machines perform such

a wide variety of work, they are particularly well adapted for the tool-room.

The jobs shown in the two illustrations are representative of "Milwaukee" adaptability. The upper illustration shows a jig being bored with a fly cutter. The lower illustrates the milling of a chilled roll with the use of a Universal Milling Attachment.

Write for catalogue—NOW.



KEARNEY & TRECKER CO.
MILWAUKEE, WIS., U.S.A.

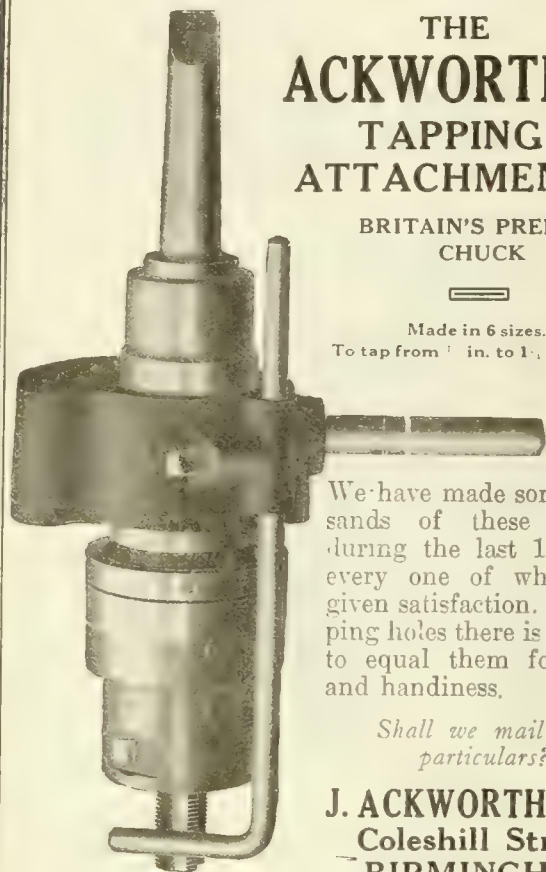
Canadian Representatives: Williams & Wilson, Ltd., Montreal; F. F. Barber Machy. Co., Toronto; A. R. Williams Machy. Co., Vancouver and Winnipeg.

If interested tear out this page and place with letters to be answered.

THE ACKWORTHIE TAPPING ATTACHMENT.

BRITAIN'S PREMIER
CHUCK

Made in 6 sizes.
To tap from $\frac{1}{8}$ in. to 1 $\frac{1}{2}$ in. Whit.



We have made some thousands of these Chucks during the last 11 years, every one of which has given satisfaction. For tapping holes there is nothing to equal them for speed and handiness.

Shall we mail you particulars?

J. ACKWORTHIE, Ltd.
Coleshill Street,
BIRMINGHAM

ACCURACY



Prompt shipments of
all Standard Sizes in
Cap Screws, V or
U.S.S.

Cap Screws, S.A.E.
Set Screws, V or
U.S.S.

S.F. Hexagon Nuts, V
or U.S.S.

S.A.E. Hexagon Nuts,
Plain.

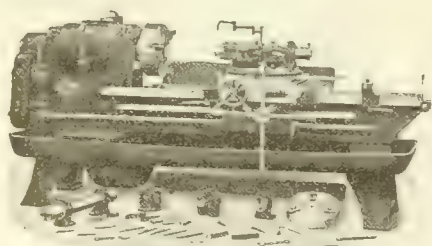
S.A.E. Hexagon Nuts,
Castellated.

Turned Paper Pins.

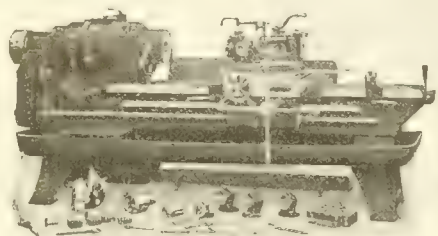
**Send us your rush
orders.**

THE
GALT MACHINE SCREW CO.,
LIMITED
GALT, ONTARIO

Eastern Representatives: The Canadian B. K. Morton Company
Limited, 49 Common St., Montreal, Que.



36" Flat Turret Lathe with Chucking
Equipment



36" Flat Turret Lathe with Bar
Equipment

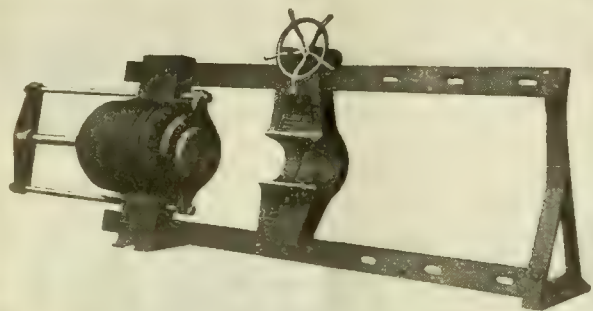
The Cincinnati Acme Delivers ALL the Power

On this Cincinnati Acme Flat Turret Lathe, the only gears running are those doing actual work—every bit of power is put directly into the job.

This machine will do both bar and chuck up to 16 in. in diameter and give the utmost satisfaction on each.

A booklet containing full particulars of our entire line of Turret Lathes and Screw Machines will gladly be sent upon request.

The Acme Machine Tool Co.
Cincinnati, Ohio, U.S.A.



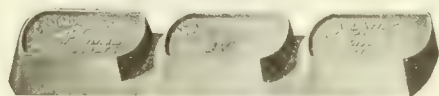
PERRIN 400-Ton Hydraulic Wheel Press

This Made-in-Canada Press is built to operate direct from Accumulator at 1500 pounds per square inch pressure.

Perrin for Reliability

WILLIAM R. PERRIN, LIMITED
TORONTO

BABBITT METALS OF PERFECTION



IMPERIAL GENUINE

For Heavy Engines and
Extraordinary Hard Work



HARRIS HEAVY PRESSURE

THE
COPPER COATED
CAKE

For Donkey Engines, Saw Carriages, Small Motors,
Transmission Line Shafting and all steady
pressure duty.



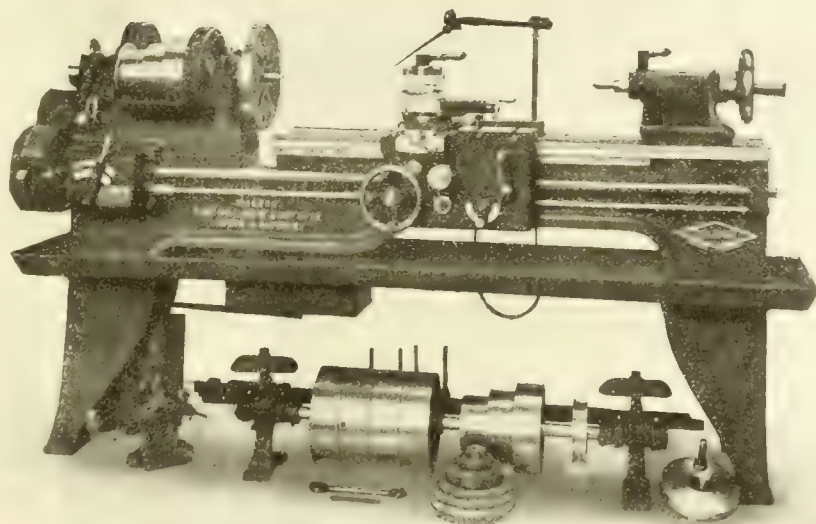
Matchless

Suitable For Slow-Moving Bearings

Write For Prices

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

The "SELSON" High-Speed, Vee Bed Gap Lathe



13" Swing

A British Lathe, built
under high production
methods.

SELSON HOUSE, 83 and 85 QUEEN VICTORIA STREET
LONDON, E.C.4, ENGLAND. **WORKS: COVENTRY**

Branches: Paris, Brussels, Turin, Milan, Melbourne, New York

New Method Saves Valuable Hours



To Duplicate Blueprints

Tracing them in the drafting room takes hours — sometimes days — of a highly paid man's time, always with a chance of errors.

The PHOTOSTAT accomplishes the same result in a few minutes at a cost of a few cents and without errors.



To Make Drawings of Small Machine Parts

in the drafting room, costs many dollars and takes hours or days of time.

A PHOTOSTAT copy of a small machine part accomplishes the same result and is made in a few minutes at a cost of a few cents.



To Make Advertising Layouts

by hand for six or a dozen publications requires hours of work by an expensive man.

The PHOTOSTAT quickly duplicates the original layout at the required size and as many times as desired at a cost of a few cents apiece.



To Copy Catalog Pages

letters, reports, charts, etc., takes hours of a stenographer's time. The results cannot be exact duplicates and there are frequent errors.

The PHOTOSTAT produces an exact duplicate, without errors, in a few minutes, at a cost of a few cents.

The PHOTOSTAT

(Trade Mark Registered)



is the Up-to-Date
Method for Doing
All This Work

Photographic Copying Machine

Cuts Hours to Minutes
Cuts Dollars to Cents
Makes No Mistakes

"The machine pays for itself in 8 or 9 months,
because of its man power savings."

Manufactured by the Eastman Kodak Company Exclusively for

PHOTOSTAT CORPORATION

ROCHESTER, N.Y.

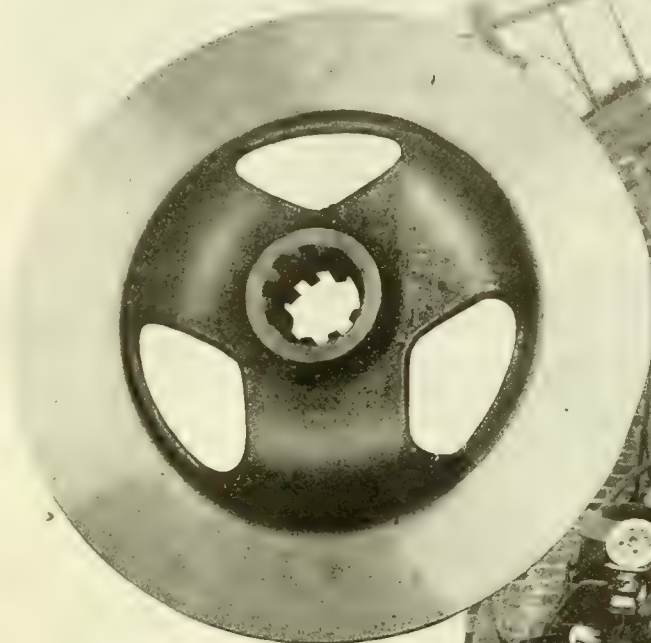
CHICAGO NEW YORK CITY PHILADELPHIA PROVIDENCE
BOSTON SAN FRANCISCO WASHINGTON

AGENCIES

Alfred Herbert, Ltd., Coventry, England.
Societe Anonyme Alfred Herbert, Paris, France.

Societa Anonima Italiana Alfred Herbert, Milano, Italy.

Societe Anonyme Belge Alfred Herbert, Brussels, Belgium.
Graham Bros., Stockholm, Sweden.



**When
Friction
Disc
Grinding**



HEALD STYLE No. 22 EATS 'EM UP

We've always said so but you don't have to take our word for it. Ask the Borg & Beck Co., Chicago, in whose plant the above photographs were taken. They are using three No. 22 Style Heald Rotary Surface Grinders to finish the friction faces of friction discs.

As the top picture shows, these cast iron discs are held on a Heald 12-in. Magnetic Chuck equipped with a special auxiliary top plate. This was cut out in the center to allow the web and hub to drop in when grinding the upper side. Stock removed is .005 to .010 with .003 tolerance. Production is 90 an hour.

Our Engineering Service Department can, in exchange for blueprints or samples, show you how the Heald can best produce your finished work. A letter helps us both a lot.

**Heald Machine Company, 51 New Bond Street
Worcester, Mass.**

BRANCH OFFICES: New York, 839 Singer Bldg.; Philadelphia, 1302 Stephen Girard Bldg.; Chicago, 26 South Jefferson St.; Detroit, 401 Marquette Bldg.; Cincinnati, 311 Provident Bank Bldg.; Cleveland, 721 Engineers Bldg.; Buffalo, 331 Jewett Ave. WESTERN AGENTS: Eccles & Smith Co., Los Angeles, San Francisco, Seattle and Portland; Salt Lake Hardware Co., Utah and Idaho; Hendrie & Bolthoff Mfg. & Supply Co.,

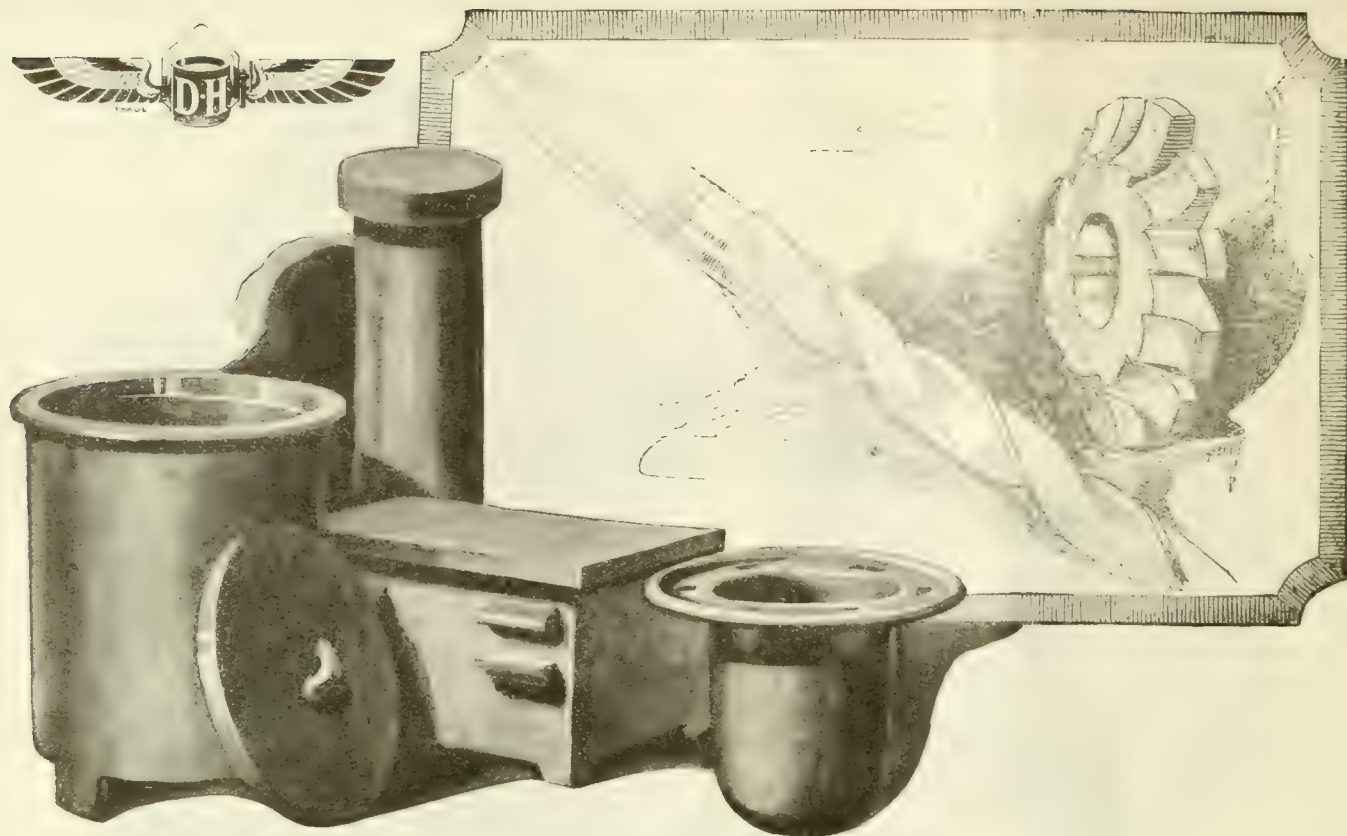
GRIND WITH A



AND BE SURE

Colorado and Wyoming. FOREIGN AGENTS: Alfred Herbert, Ltd., England; Societe Anonyme, Alfred Herbert, France; Switzerland; and Societa Anonima Italiana, Alfred Herbert, Italy; Alfred Herbert, Ltd., Sydney, Australia; Horne Co., Ltd., Japan; With Sonsen & Co., Sweden; Denmark and Norway; Henry Benedictus, Brussels, Belgium; American Machinery Syndicate, Spain and Portugal.

If interested tear out this page and place with letters to be answered.



The Mettle of the Cutting Tool

BASIC steel of proper quality may be the *beginning* of a good tool but it is far from the finished tool that meets the demands of present day practice.

And so it is with heat-treating equipment. The most highly perfected furnace equipment and other materials are handicapped if containers, muffles, racks, etc., crack, warp, scale and change in other ways that interfere with the process.

Cast Nichrome has not only contributed to surer results but is a mighty factor in heat-treating economy. Thousands of hours at 1800 deg. F.—without warping, cracking, scaling, etc.—are guaranteed. Shorter heats and less fuel consumption are inevitable. Stock patterns in hundreds of sizes; special designs for special requirements—

Heat Treating
Containers of

Manufactured under HENDERSON PATENTS by

CANADIAN DRIVER-HARRIS Co., Ltd.

WESTERN TRUNK AND LUGS
CHICAGO
2856 JEFFERSON ST.

WALKERVILLE, ONT.
CANADA
HARRISON N.J.

80 TISH WOODS
MANCHESTER
ENGLAND

Cast Nichrome

ENDURE IN HIGH TEMPERATURE

If what is advertised is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



Look in the new Starrett Catalog for the tools Experienced Machinists prefer.

Three hundred and fifty-two pages describing and illustrating Starrett Micrometers, Calipers, Protractors, Gages, Verniers, Squares and all the other tools of Starrett make, including twenty-one new tools.

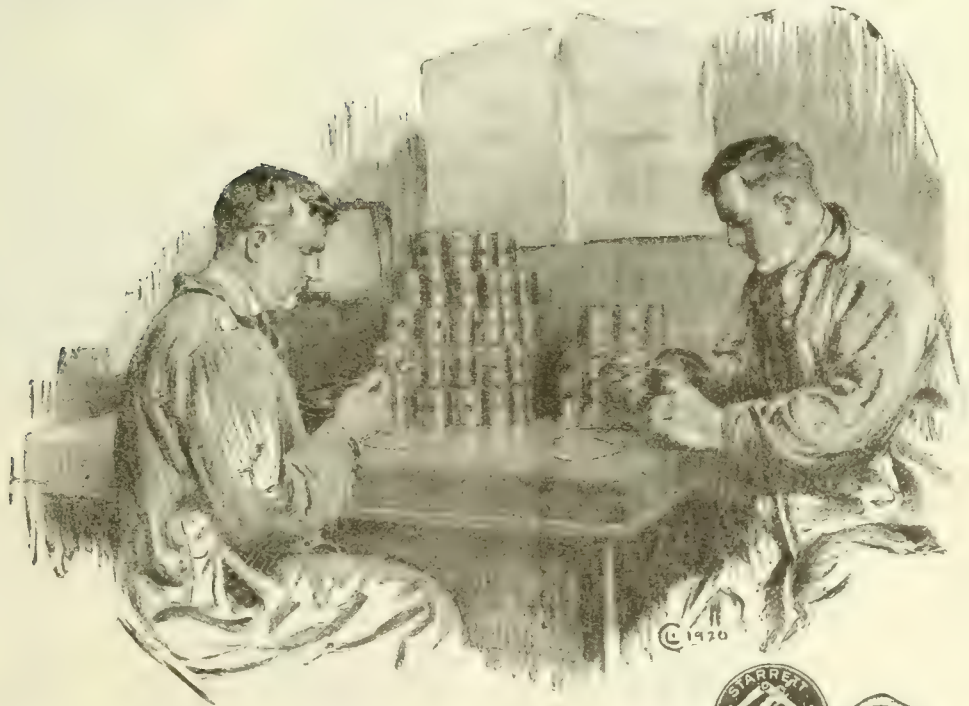
Copies are being distributed to machinists and dealers in all parts of the country.

Ask your dealer or write us today for a copy of Catalog No. 22-3.

THE L. S. STARRETT COMPANY

*The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled*

ATHOL, MASS.

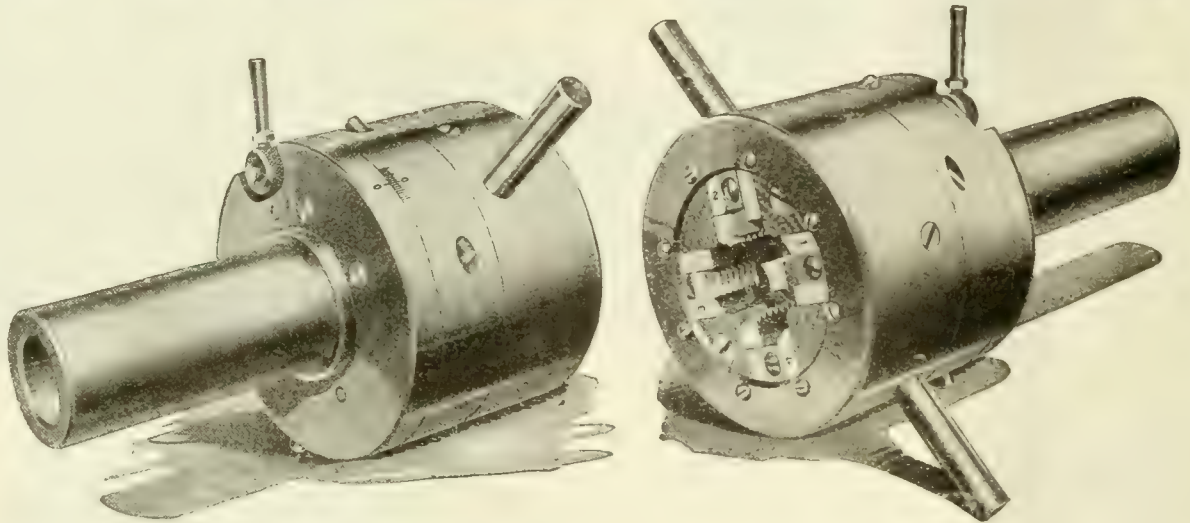


Use Starrett Tools

42-140

If interested tear out this page and place with letters to be answered.

THE VALUE OF A DIE HEAD IS WHOLLY IN THE SERVICE IT GIVES MODERN



"Moderns" have the strength for any duty within the capacity of the 17 sizes. They are widely known as **heavy duty** tools. This strength is not mere mass of metal. Strength comes more from correct design and proper relation of parts, one with another.

The Modern Self-Opening Die Heads are extremely simple. The design is distinctively and exclusively "Modern."

We have no hesitation in stating that a "Modern" will cut more clean, full-size threads, true to lead, and for a longer time without repairs, than any other kind. Hundreds testify to the fact that the "Modern" is the only one which will "stand up" in their work.

If you have a difficult threading job, or would like to speed production, send specifications and blueprints, and let our engineers study your problem.

Send for latest bulletin.

MODERN TOOL CO., Erie, Pa.

Main Office and Works: STATE and PEACH STS.

Branch Offices:

New York, N.Y.: 54-60 Lafayette Bldg.

Detroit, Mich.: 408 Kerr Bldg.

Cleveland, Ohio: 408 Frankfort Ave.

Chicago, Ill.: 32 N. Clinton St.

Philadelphia, Pa.: The Bourse.

Buffalo, N.Y.: Associated Service Bldg.

Export Dept., Bishop Bldg., New York, N.Y.

Californian Representatives: Herberts Machinery & Supply Co., Los Angeles, and San Francisco.

Canadian Agents: Rudel-Belnap Machinery Co., Ltd., Toronto and Montreal.

Superheat Drills Holes

Few "steam metals" can withstand its active chiseling action

SO in great valves that control superheat flow for vital power production, leading designers call for essential working parts of Monel to withstand high speed gas erosion.

For, of all commercial metals, Monel alone has the ability to survive the combined chemical and mechanical attack of superheated steam at the high and rising pressures commonly used today.

In proof of this, Monel is used for guide stems, wedges, seat rings, spindles, dash pots, piston rings, clappers, piston lock nuts, pistons, etc., in the huge control valves built by Jenkins, Pratt & Cady, Crane and others equally prominent.

Monel is standard for service calling for acid, alkali, high heat and steam wear resistance. It has a prominent place in the specifications of such seasoned engineering organizations as J. G. White, Stone and Webster, Dwight P. Robinson Inc. The name Monel identifies the natural nickel alloy—67% nickel, 28% copper and 5% other metals—produced by The International Nickel Company.

THE INTERNATIONAL NICKEL COMPANY
OF CANADA, LIMITED
Harbor Commission Building

TORONTO

ONTARIO



THE larger picture is a "close up" of the clapper and seat ring shown in the broken out part of the small valve illustration. The clapper is seen about to lift in order to allow steam to pass into the line. The irregular spurts of steam show that the seat between clapper and ring is no longer perfect—that superheat has commenced to drill its way through. This drilling action is always in process where superheat is used, and the commonly used metals for valve parts eventually fail and allow superheat to cut through. For that reason, Monel is the only safe metal for valve parts that are in constant contact with superheated steam—the only metal that insures always tight valve closure.



Monel metal

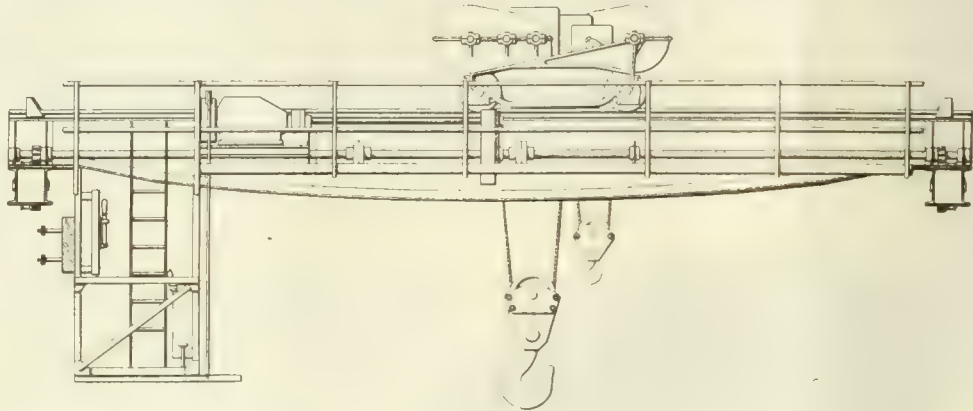
THE INTERNATIONAL NICKEL COMPANY



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CRANES

ELECTRIC AND HAND OPERATED



DOMINION BRIDGE COMPANY LIMITED

HEAD OFFICE & WORKS: MONTREAL BRANCHES:-OTTAWA, TORONTO, WINNIPEG

HYDRAULIC TURBINES AND PUMPS

Our shops are equipped for building TURBINES of the largest sizes —also high speed PUMPS of large capacity for medium and low heads. Two turbines of 20,000 H.P. are now under construction.

PAPER MILL MACHINERY

Pulp Drying Machines.
Millsaugh Suction Rolls.
Millsaugh Shower Pipes.
Davies Oscillating Suction Boxes.
Press and Felt Rolls.
Brass Covered Rolls.
Pulp Digestors.
Barking Drums.
P.A.P.A. Screens (Spangenburg System)
for pulp and paper.

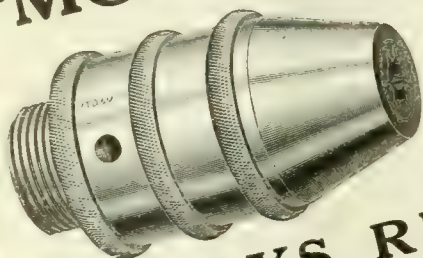
DOMINION ENGINEERING WORKS, LIMITED
MONTREAL - QUE.

"MORSE" CHUCKS

ARE MADE OF THE
HIGHEST GRADE
STEEL

ARE CAREFULLY
INSPECTED AFTER
EVERY OPERATION
AND

ALWAYS RUN TRUE



"MORSE" DIES

(ROUND)

WILL PRODUCE CLEAN
ACCURATE THREADS
AND MAY BE ADJUSTED
WHILE IN THE HOLDER



SOLD SINGLY AND IN SETS IN STANDARD THREADS

Morse Twist Drill & Mch. Co.

New Bedford, Mass.,
U. S. A.

The "OLIVER"

No. 404 High Power Filing Machine

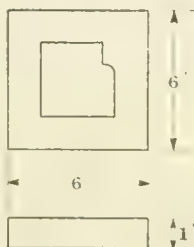
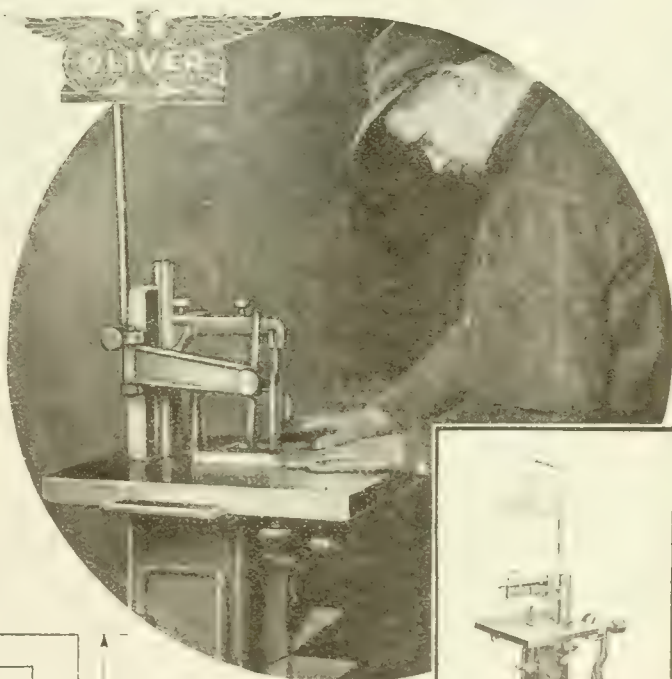
(Rearwin Patent)

After more than five years of service, this Oliver 404 High Power Filing Machine is still the favorite at the Manhattan Machine & Tool Works, Grand Rapids, Mich., for filing dies, stripper plates, templets, etc. It is a profitable producer—quicker and less expensive than hand filing and has exclusive features which make it distinctive among machines of its class.

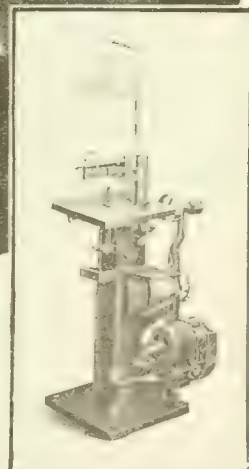
When photographed the machine was working on a stripper plate for a notching die—the character of the operation being indicated in the sketch.

We have just developed a still larger Filer. Write for particulars.

OLIVER MACHINERY CO.
GRAND RAPIDS MICHIGAN



Description of this
and other machine
of the "Oliver" line
on request.



ALLOY STEELS

Open Hearth and Electric Furnace

Bars—Hot Rolled and Cold Drawn.

Billets—Slabs—Blooms.

Chrome-Vanadium
Nickel 3½% and 5%
Chrome-Molybdenum
Chrome-Nickel
Magnet Steel
(Tungsten and Chrome)
Carbon-Chrome
Nickel-Chrome-Molybdenum
Nickel-Chrome-Vanadium
Chrome
Ball and Race Steel
Electric Furnace Hi-Carbon
Special Analyses

When you purchase or specify our Alloy Steels for your product, you get with the steel the assurance that a competent metallurgist is at your service in the working and treatment of that steel.

Our standard analyses embrace all types of Commercial Alloy Steels—open hearth and electric furnace grades—and our specialization in the manufacture of Alloy Steels enables us to assist our customers in the selection of the correct steel for their requirements.

We melt—roll—cold draw—heat treat—our steels in one large plant, and under expert supervision.

Avail yourself of our Consultatory Service

If you have any place in your manufacture where you think you could use an Alloy Steel to advantage, give our engineers the opportunity of assisting you in the selection of the proper grade and type.

UNITED ALLOYSTEEL CORPORATION

CANTON, OHIO

Detroit
Syracuse
Cleveland

Philadelphia
New York
Indianapolis

Chicago
San Francisco
Portland

And yet you encourage this!!!!

The body of a high speed reamer is the *lounge lizard* of tooldom—it leads a lazy life of expensive ease—while the blades do the work. And you support this lounge lizard, you pay for its luxury.

And in return it renders you nothing but *brittleness* and *breakage* because even its lazy life is too strenuous for its tender nature.

PEERLESS ~~HIGH SPEED~~ REAMERS

Peerless High Speed Reamers on the contrary have bodies of a tough stalwart sort of steel—not expensive to support—fully capable of handling the sort of work it has to do—fully able to absorb the shocks and strains which smash a body of expensive high speed steel.

Peerless blades however are of high speed steel—especially selected stock treated especially to develop and preserve its cutting powers. The blades and body are then united by a patented process that makes the two one eternal unit—tough where toughness is needed, high speed where high speed is needed.

“Peerless” has no shiftless steel in its makeup—every bit of the tool is ready for the work expected of it—the body for the sudden shocks and strains—the blades for the punishment of high speed reaming—Do you wonder that we dare to ask to—

Try to Stump “Peerless” On Your
Toughest Job.

The Cleveland Twist Drill Co.

CLEVELAND NEW YORK CHICAGO

Agents for Europe, Cleveland Twist Drill Co., (Great Britain) Ltd.
36-37 Upper Thames St., London, E. C. 4.



If interested tear out this page and place with letters to be answered.

MADE
IN CANADA

MALLEABLE AND CAST IRON PIPE FITTINGS

Annual Capacity
6000 Tons

Quality Products

Prompt Service



Brand Pipe Fittings, Screwed or Flanged, Black or Galvanized.

We are equipped to make the general run of malleable and grey iron castings for machinery manufacturers, agricultural implements, automobiles and specialties.

Cast Iron Fittings

stamped with our trade-mark mean fittings made with iron of high tensile strength—proper proportions and correct tapings.

A trial of our pipe fittings will prove the quality of service they give.

RECESSED DRAINAGE FITTINGS

Malleable Fittings

of our brand mean fittings made of *Air Furnace Refined Iron*, reamed and tapped to gauge with perfect threads.

International Malleable Iron Company, Limited
GUELPH, CANADA

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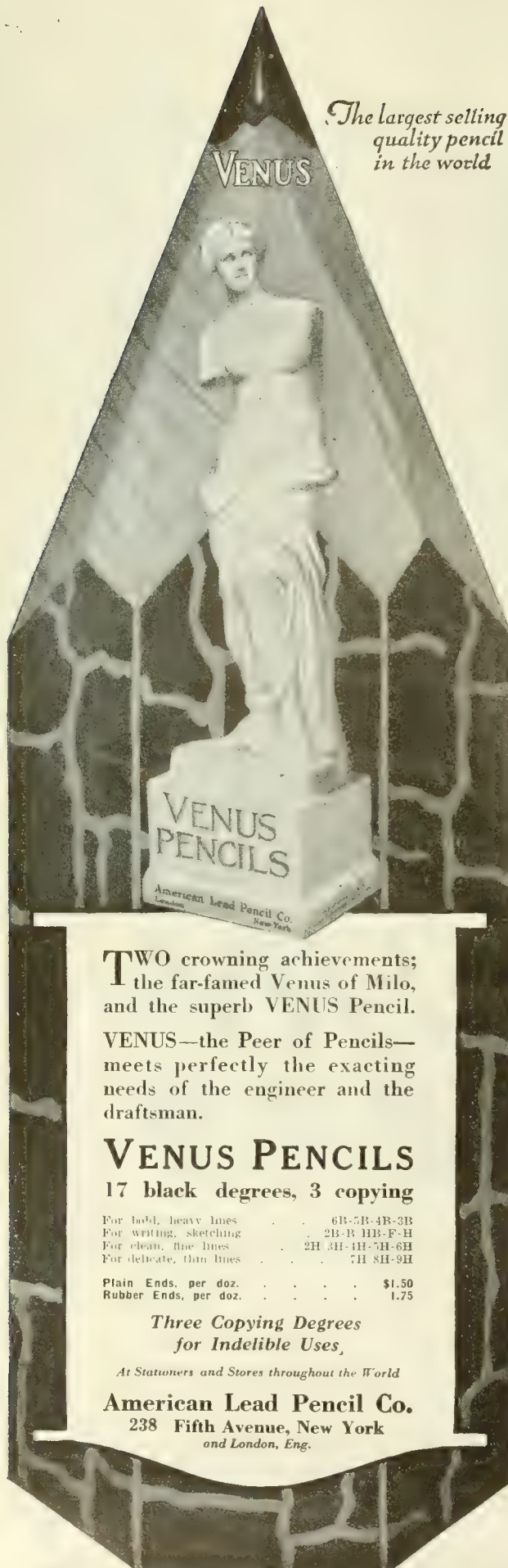
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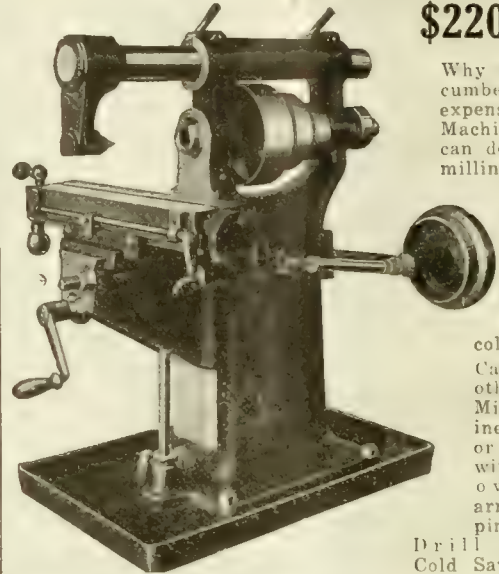
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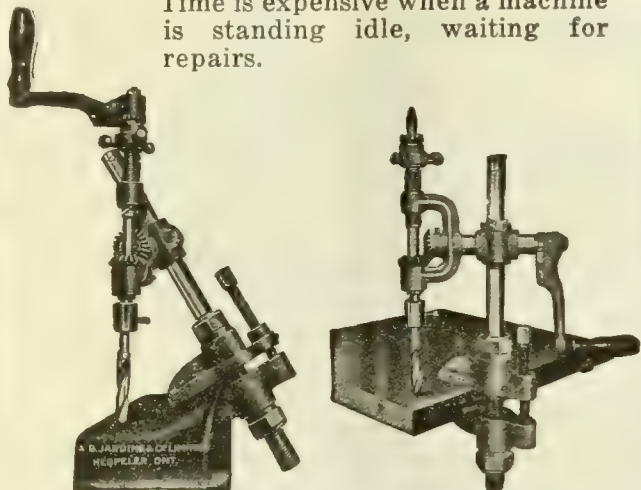
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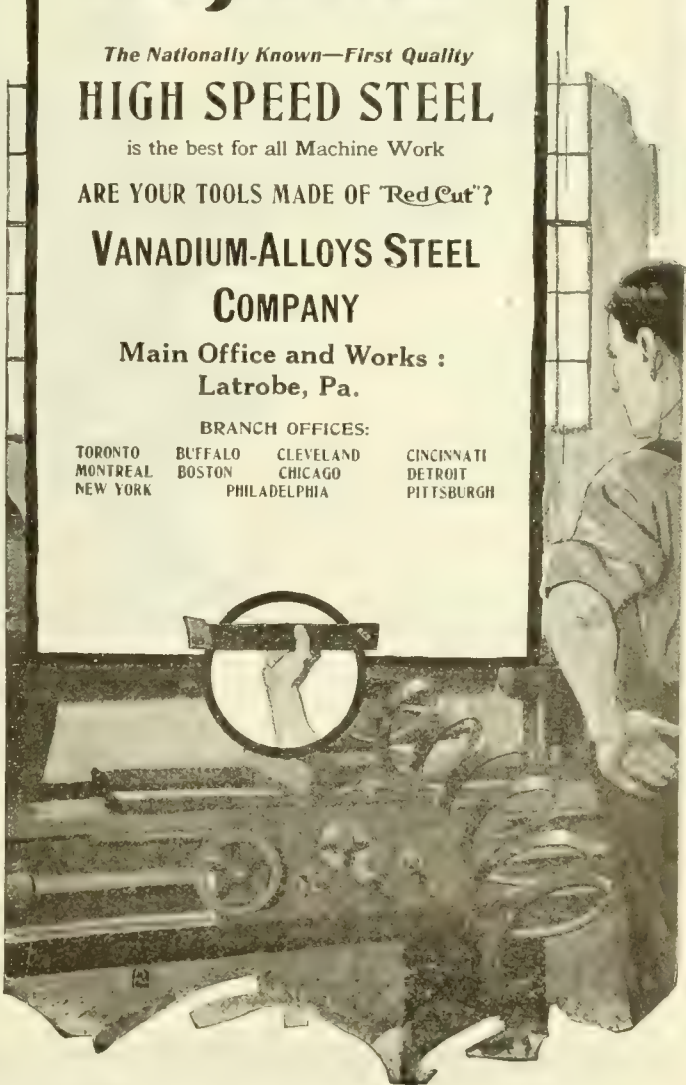
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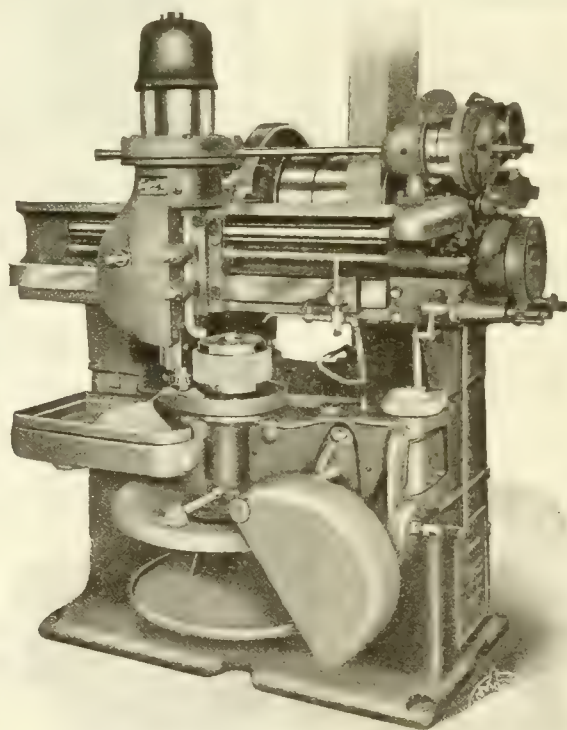
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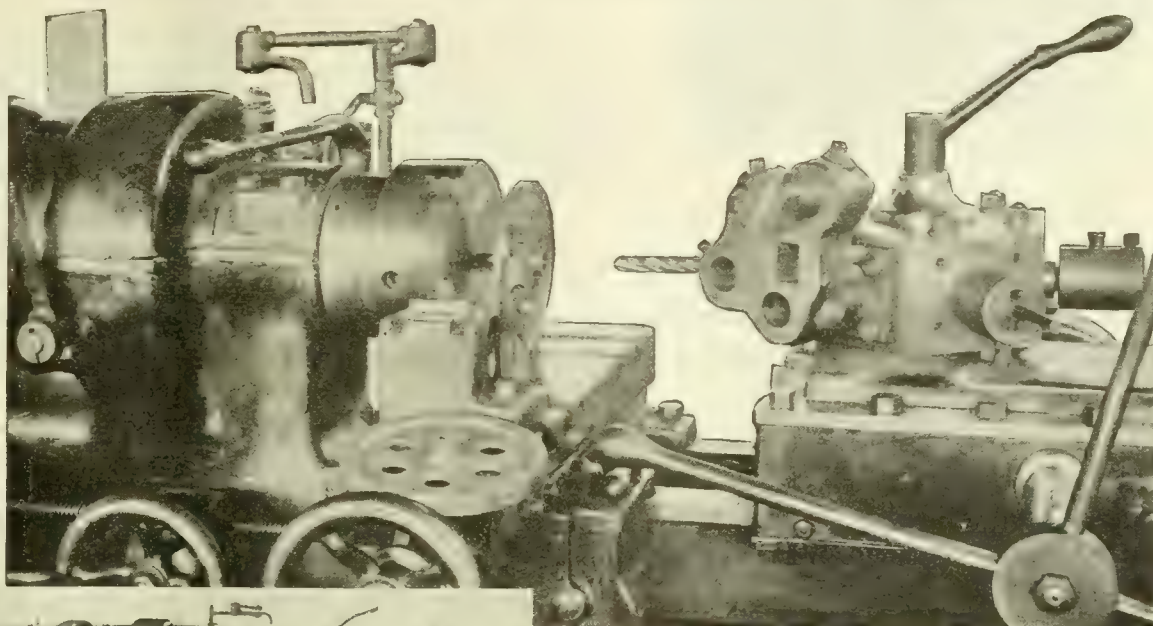
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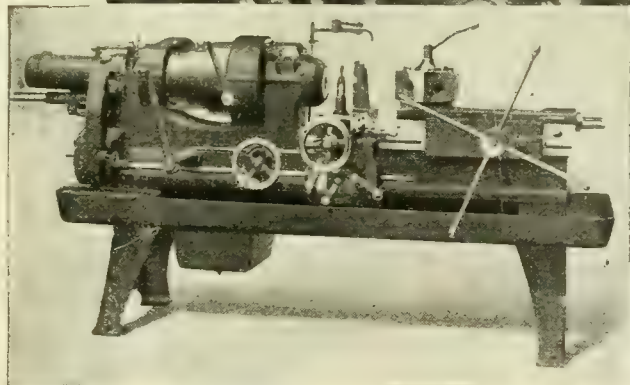
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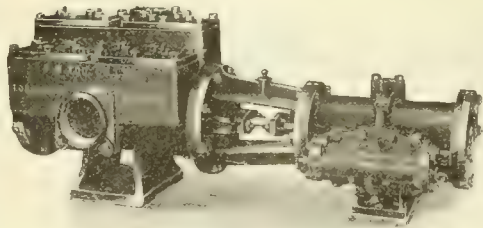
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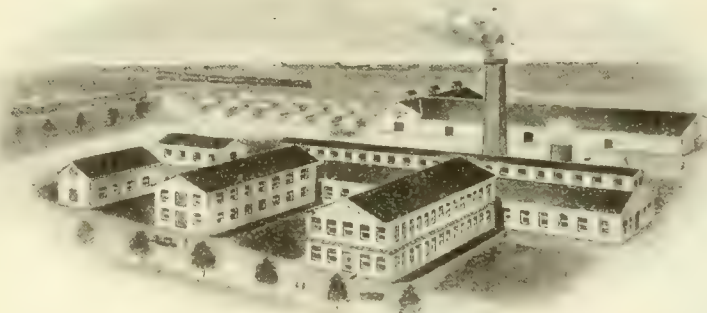
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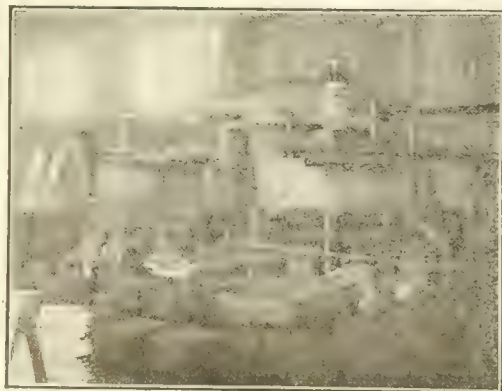
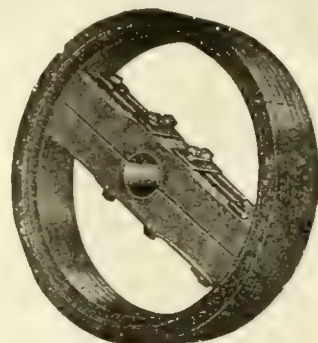
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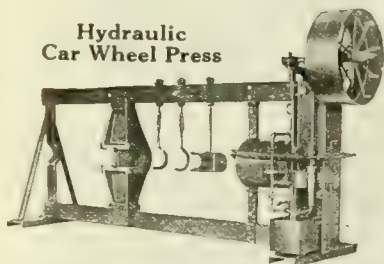


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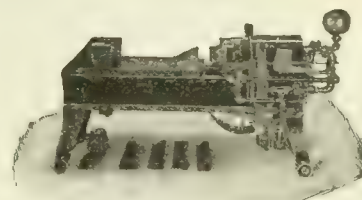
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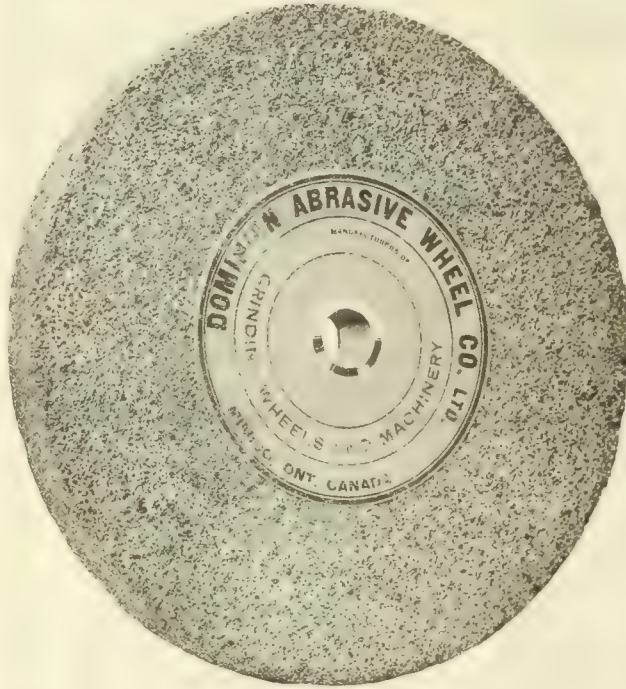
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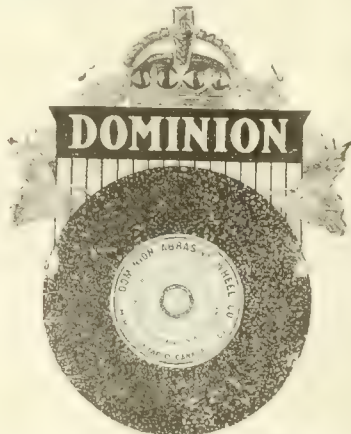
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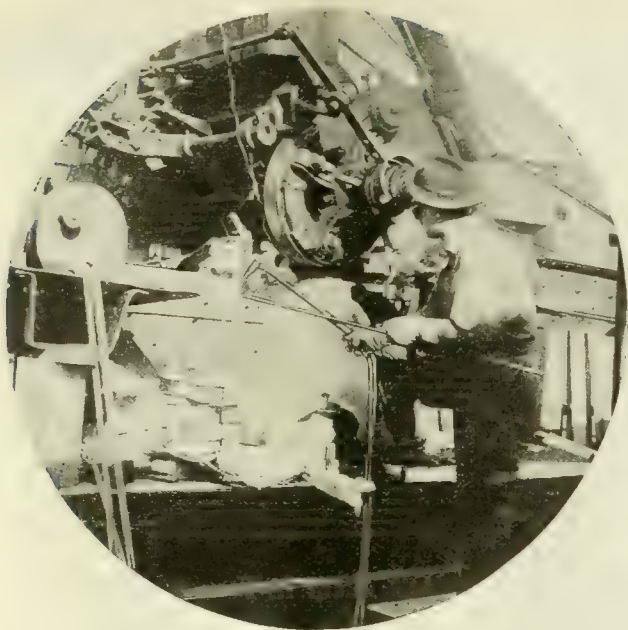


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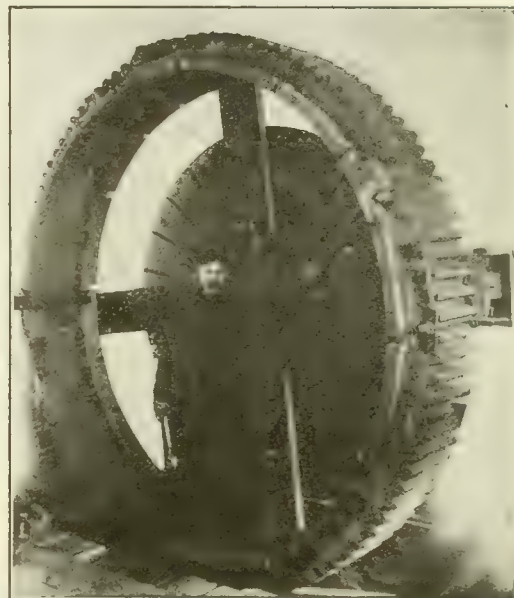
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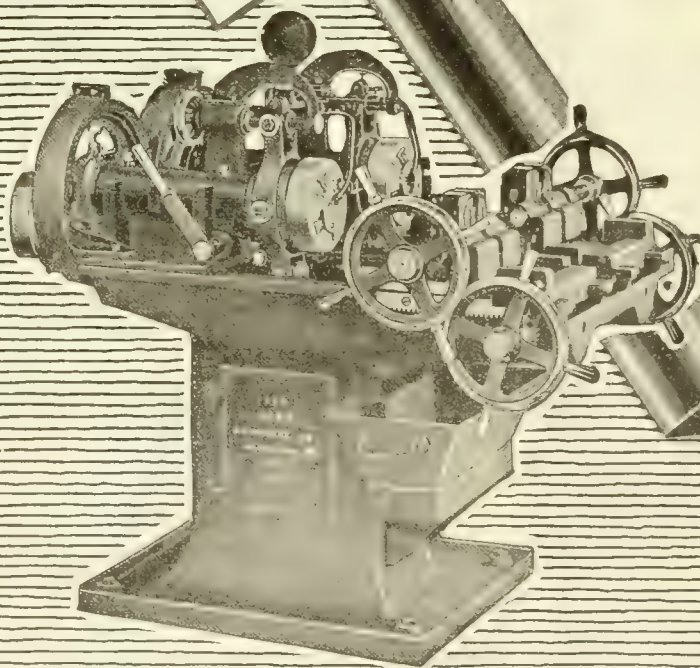
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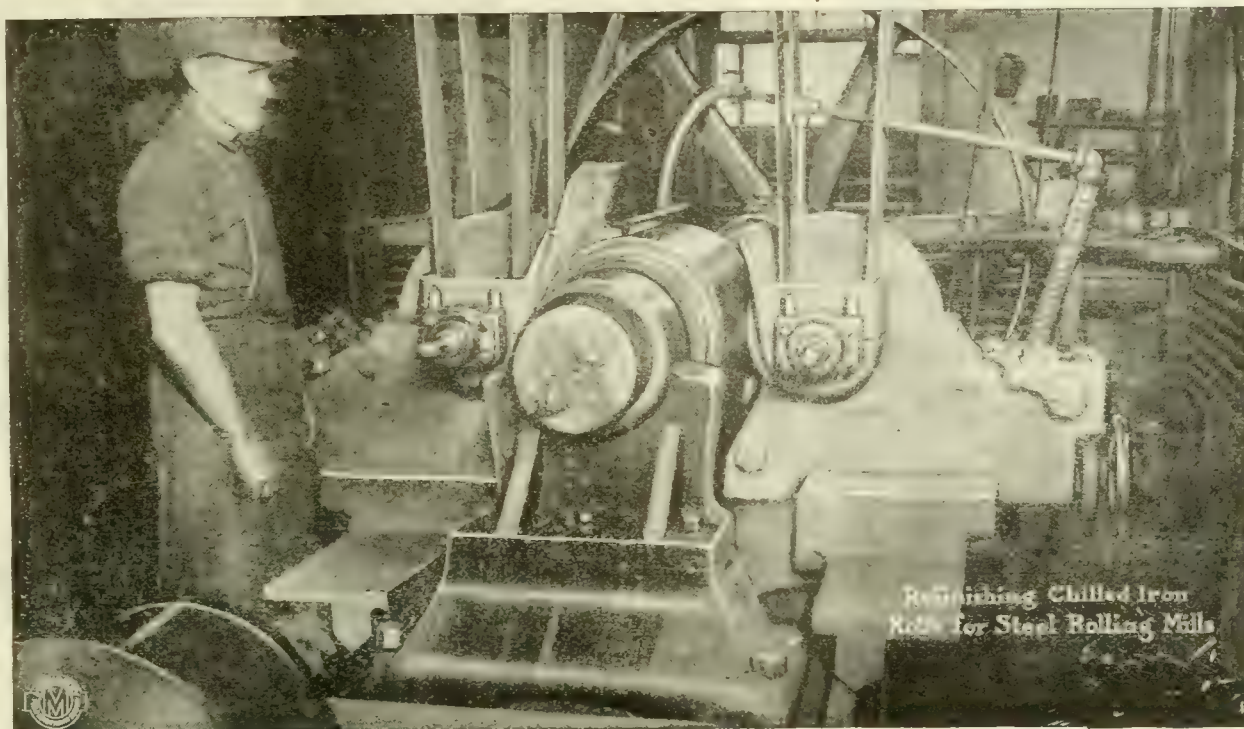
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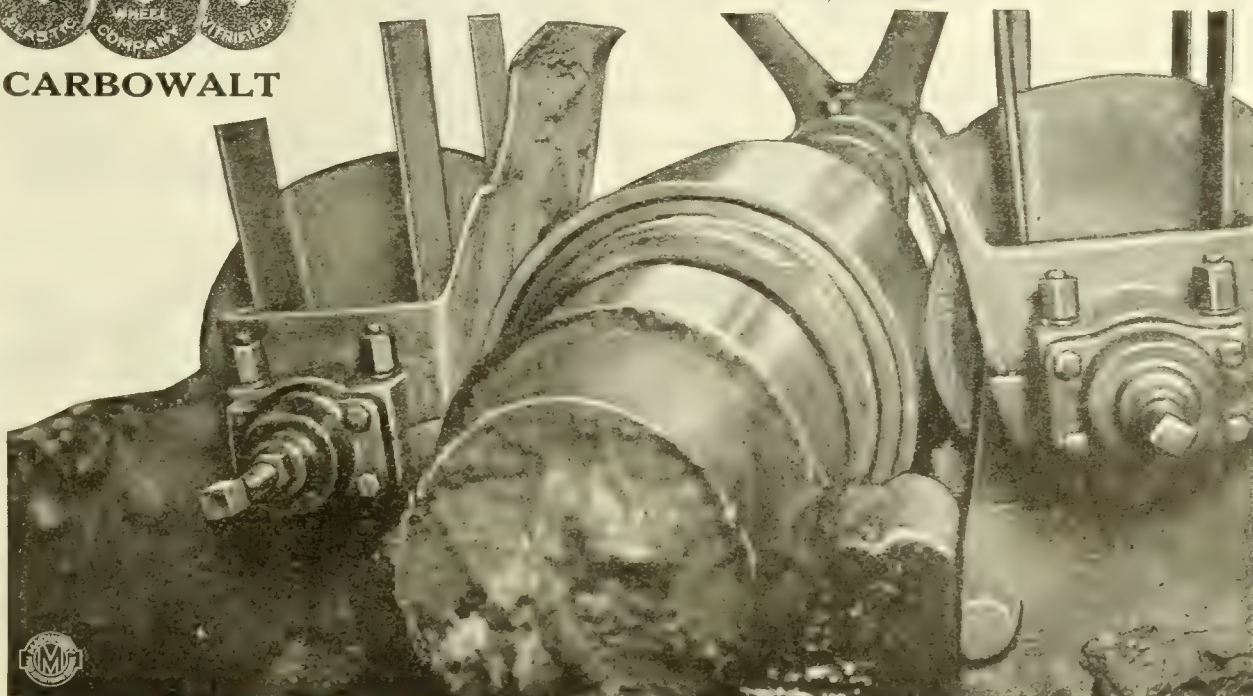
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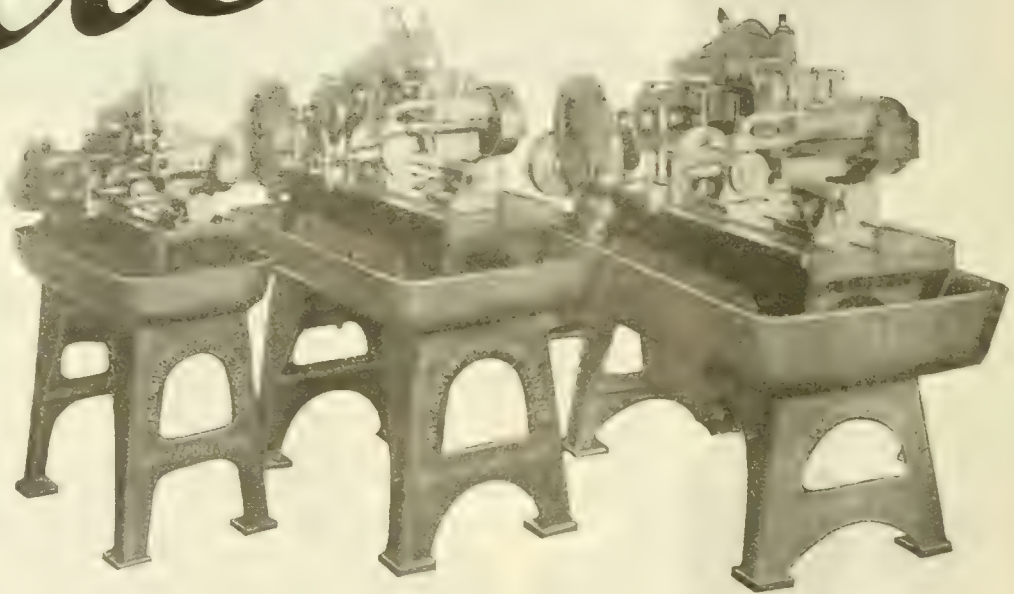
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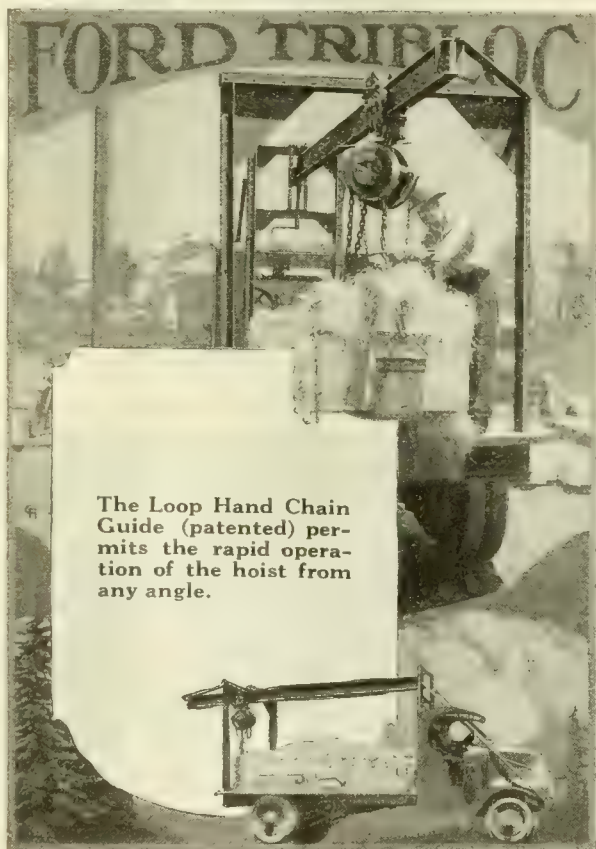
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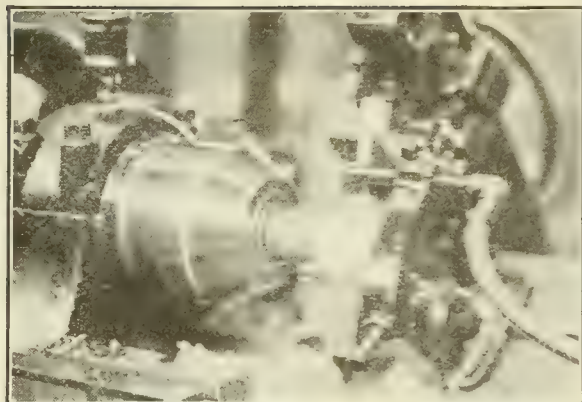
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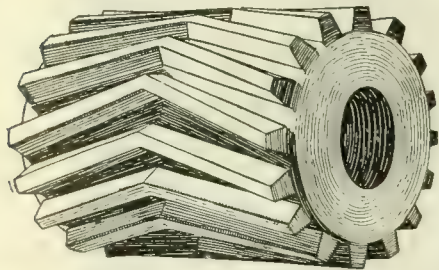
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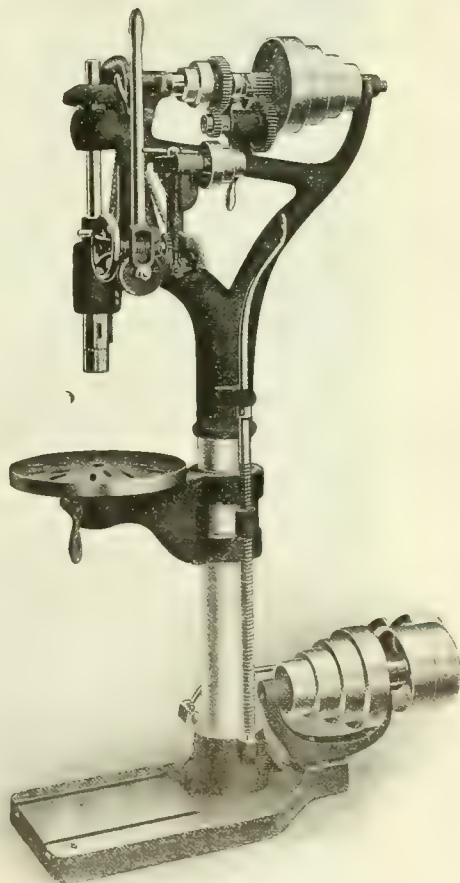
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No. 114



1921

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How to Save Money on Hack Saw Blades

Do you "get prices" when you buy hack saw blades? If you do, you are fooling yourself.

The place to save money on hack saw blades is not on the purchasing agent's desk, but in the shop.

Cost per blade has but little or nothing to do with hack saw economy. The blade that will really save money for you may cost a little more per blade, but a great deal less per cut. Figure cost by service rendered and you will realize why so many purchasing agents have changed their specifications from "Star Blades or equal" to "Star Blades—no substitute."

You can use one Star Saw on more kinds of sawing and use it longer.

You have fewer blades to buy; that means you have less money tied up in stock and less chances to run out of sizes.

Star Saws are standardized for all kinds of cutting. You can keep a medium-sized blade in your machine and use it for all kinds of work except very large or small cuts.

It all depends on the way Star Saws are made. In Star blades, the greater amount of tungsten and the acute cutting angle of the teeth enable you to go through heavy work almost as easily as light work—the hardest steel as well as the softer metal.

Don't let "prices" fool you. It's the work that the Star does out in your shop that saves you money.

Star Saws are Now Sold By the Makers

We now sell our own product, for we believe no other organization is in such a good position to give selling service on Star Saws as our own factory that has made them for 37 years.

We are not satisfied only to sell you Star Blades, but stand ready to render you every service in getting the best results in their use.

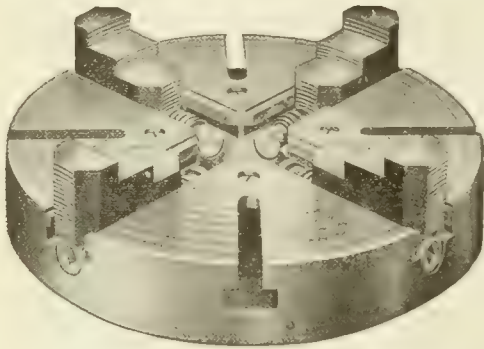
CLEMSON BROS. INC.
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STAR HACK SAW BLADES

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We make a complete line of steel chucks, including **Geared Scroll Chucks and the Geared Scroll Combination.** These types are conceded to be unparalleled for heavy work and hard usage. Write for our illustrated catalogue.

ALL STEEL INDEPENDENT CHUCKS

will put your work on new standards for accuracy and fast production. Independent Chucks are built for abnormally hard wear—the kind of usage that calls for great strength and long wearing qualities. Independent All Steel Chucks have proven so satisfactory that they are almost a necessity wherever high-speed cutting tools are used.

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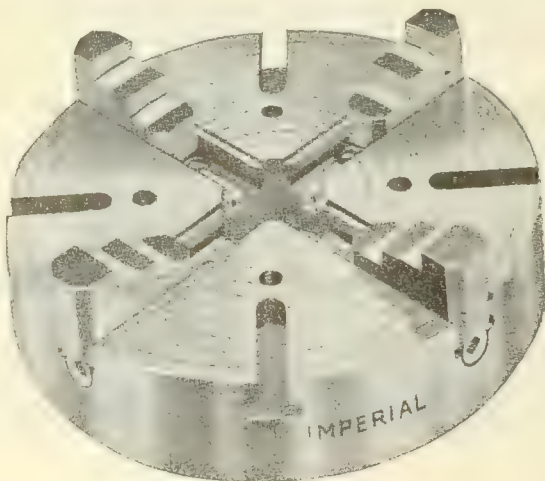
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IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.

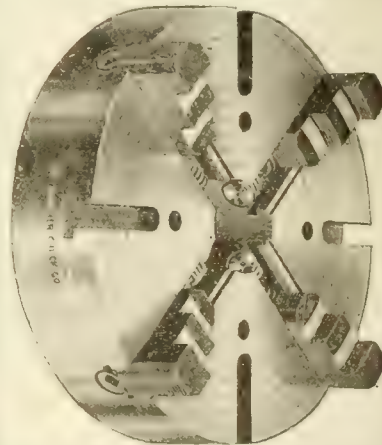


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Strong Chucks—

That truly describes Skinner Steel Body Independent Lathe Chucks. They are not only strong and powerful, but wonderfully accurate. The



SKINNER Steel Body Independent Lathe Chuck

is a single steel casting of great strength, well proportioned and accurately finished. Face is graduated accurately in inches. Screws and bearings are made of the toughest steel to withstand abnormally hard wear.

**4-Jaw Independent Chuck,
Steel Body, for Heavy Duty**

The dependability of Skinner Steel Body Independent Lathe Chucks is conclusively proved by the fact that not one has ever been known to break in service—and we have been making them for many years.

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The man who knows threading knows that there is a vast difference between mere theory and good threading practice.

He is buying THREADS—wants the greatest number of pieces per day—wants them to fit the gage and at cost which he is proud to turn in for inspection.

These are exactly the factors that are considered most important in building NAMCO Collapsing Taps—they are also the factors you should fully investigate in connection with YOUR WORK.

You are buying THREADS, not mere tools.

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Industrial Bridges, Buildings,
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vators, Derricks.

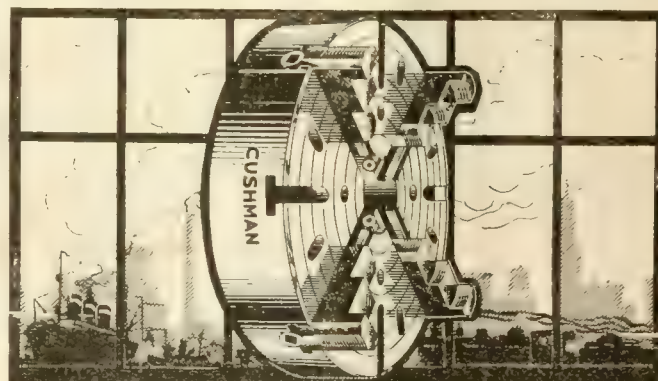
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Work, and a combination of the
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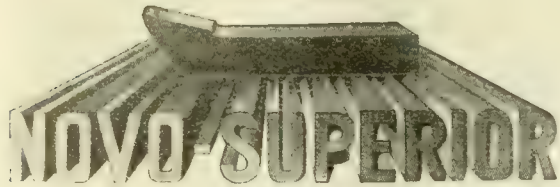
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**THE CHUCK
WITH A REPUTATION
TO MAINTAIN**

**"CUSHMAN"
CHUCKS
1862**

**THE CUSHMAN CHUCK CO.
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HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters,
 Files, Etc., Music Wire for Springs, Steel Balls.
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*The back
 of the Ox*



is the part where the fibre of the
 hide is tightest and unaffected by
 the action of breathing, therefore
 the most suitable to produce a
 dead straight and practically
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Tullis
LEATHER BELTING
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is made entirely from this portion
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Established 1834

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UNIVERSAL SUPPLIES Limited
 Room 25, 204 St. James Street
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Why I Increased My Space in Business Papers for 1921

—By a Manufacturer

- (1) "Business conditions are fundamentally sound.
- (2) "My goods will have to be *sold*, not just bought.
- (3) "I propose to cut travelling costs by relieving salesmen of work that advertising can do better and more cheaply.
- (4) "My advertising will aid in the restoration of Confidence.
- (5) "Increased sales resistance calls for added sales effort.
- (6) "Conditions make your papers more indispensable, more closely read.
- (7) "I know they reach my market without waste.
- (8) "Because they are doing a big, constructive, creative work—benefiting me through promoting the welfare of my customers.
- (9) "It is time to intensify sales forces of proven productivity and low cost.
- (10) "I need the business."

Just Common Sense

—a good many will say. Nothing here that everyone does not know, but half of wisdom consists in *being wise in time*. This advertiser not only did some clear thinking, but he acted.

Ask our Advisory Service Department for any help you need in working out the right plan and schedule for your business in 1921. No charge or obligation of any kind.

All Business Papers are good, but some are better than others. The phrase "Member of the Associated Business Papers, Inc.," means proven circulation PLUS the highest standards in all other departments.

Canadian Machinery is a Member of the Associated Business Papers and also of the A. B. C.

THE ASSOCIATED BUSINESS PAPERS, Inc.

Jesse H. Neal, Executive Secretary

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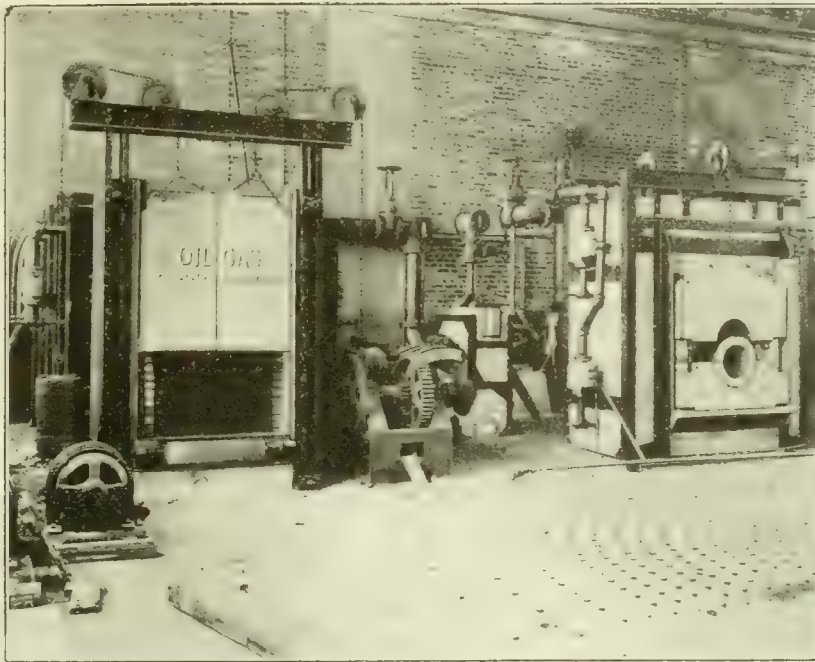
220 W. 42nd Street

New York

OILGAS INDUSTRIAL FURNACES

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"OILGAS" FURNACES AT CRANE LTD., MONTREAL

As the Tungsten Lamp is to the Carbon

The relation of the new type of "OILGAS" furnace to former designs is similar to that existing between the old type of carbon bulb and the modern tungsten. The "OILGAS" way is the modern way!

If the work requires *heat*, we can supply an "OILGAS" furnace to handle it with the highest degree of efficiency and economy.

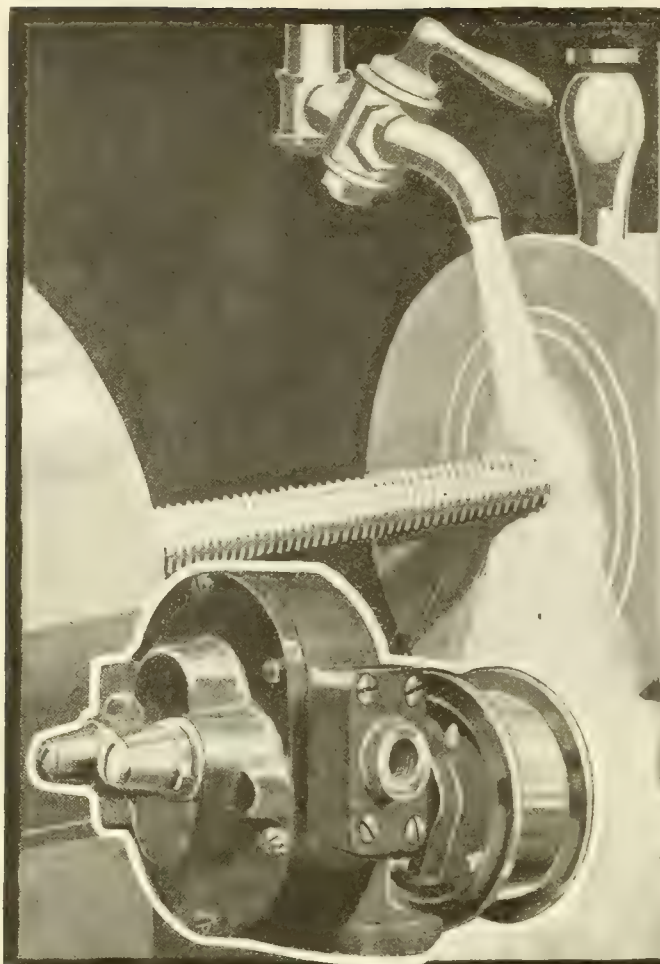
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MONTREAL

"Experts in the economical combustion of liquid fuels."



TRAHERN

Better Threads

One of the vital necessities for cutting clean and accurate threads, is a steady stream of coolant kept flowing upon the chasers of the die head. The coolant gives longer life to the chasers, keeps them cool, and makes threading much easier.

But a dependable circulating pump is necessary to assure a steady flow of coolant.

Trahern Rotary Geared Coolant Pumps are furnished as regular equipment on leading machine tools to-day. They throw heavy, forceful streams entirely free from pulsation. Supply can be shut off at discharge without stopping the pump, assuring the right quantity of coolant at the proper time. Will pump water, oil or compound. Operate at low speed, guaranteeing long life. If necessary will work against 100 lbs. pressure. When properly installed, guaranteed not to lose their prime.

For high quality threads, equip your machines with TRAHERN Pumps. Our catalog No. 11 explains in detail.

TRAHERN PUMP DIVISION

Geo. D. Roper Corporation
ROCKFORD, ILL.

SaBeN ExTrA HIGH SPEED STEEL

The Highest Achievement
of British Tool Steel
Metallurgy

H.A. DRURY COMPANY
LIMITED

MONTREAL TORONTO NEW YORK
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W. ATKINS & CO. Sheffield ENG

The HIGH SPEED STEELS

For superior cutting power:

"Double Waco" and
"Waco Superior"

Carbon Tool Steels

For all Purposes.

"Turtle Brand," unequalled for reliability.

MINERS' DRILL STEELS

Solid and Hollow.

All Sections.

Representative

MARSHALL SON & BUNNEY

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STEEL for Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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Steel Ingots
by the

HARMET

Liquid Process





Electric and Oxy-Acetylene WELDED TUBING

Also BUTT SEAM TUBING

We have a thoroughly equipped plant for Welding by Electric and Oxy-Acetylene processes. Butt Seam Tubing is also one of our specialties. Tubing made hot or cold rolled finish.

Our Work Includes Tubing for

Bicycles, Bedsteads, Automobile Parts, Electric Fixtures, Gas Fixtures, etc. Round, Square, Rectangular and Special Shapes. Sizes $\frac{3}{8}$ in. to 2 in. outside diameter, from 16 to 22 gauge. Also equipped for bending 16 gauge or lighter, any shape or radius.

Let us advise you of the kind of tubing that will best suit your requirements. Inquiries gladly answered.



233 Dufferin Street, TORONTO, Canada



No. 2 TYPE "R" Hartness Automatic Die

WITH SHANK FOR REVOLVING SPINDLES

These dies are designed for use on either vertical or horizontal spindles. Die is re-locked by forward motion of sleeve, which may be actuated by a yoke working in the groove or by a fixed stop making contact with rear edge of sleeve at the return stroke. Die is unlocked in the usual manner by retarding its forward motion or by a fixed stop, making contact with the external tripping button shown on the face of the die. External tripping button is especially desirable in cutting very short threads as it relieves the thread of the strain incidental to unlocking by the pull-off device.

The diameter of the No. 2, Type R die is 3.3-16 in., and its length as shown is 3½ in.

The Die cuts both right and left-hand threads ½ in. to 1 in. in diameter, and from 10 to 40 threads per inch.

Shanks are varied to meet individual requirements.

A set of standard chasers in carbon steel is supplied gratis with each Die.

No tools of any kind need be used in changing chasers.

A chaser grinding jig is supplied gratis on Die orders if desired.

Jones & Lamson Machine Company

(DIE DIVISION)

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SPRINGFIELD, VERMONT, U.S.A.

503 Market St., SAN FRANCISCO,
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Versatility

A tool room to be complete must be equipped with machines of sufficient adaptability to handle varied and difficult jobs.

Combining as they do both an external and internal grinding machine, the versatility of Landis Universal Grinding Machines is practically unlimited.

Economical, efficient grinding is the rule wherever Landis Grinders are used. Let us explain the many features of this machine in detail.

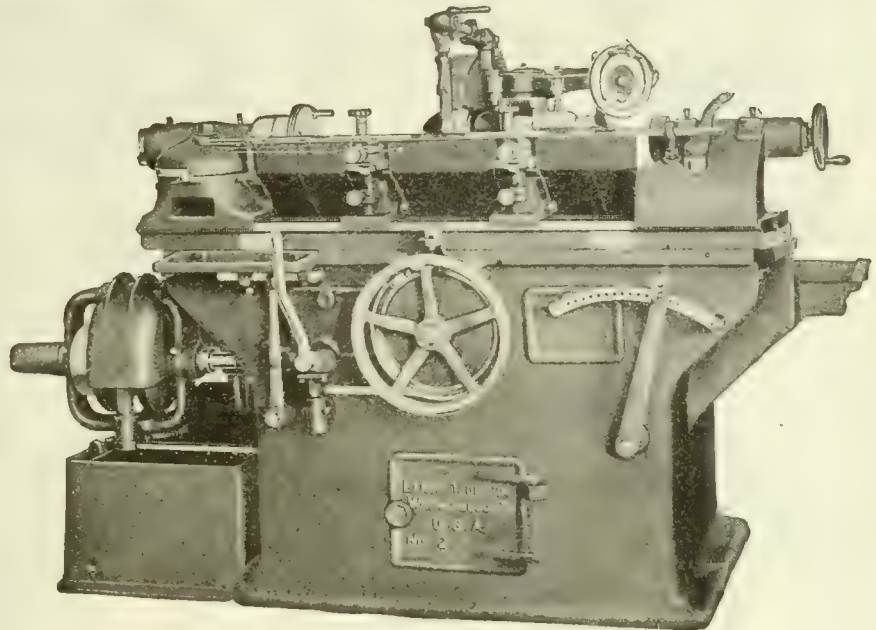
Landis Tool Co.

Waynesboro, Pa.

New York Office: 56 Church St.

LANDIS

UNIVERSAL GRINDER



More Speed
Better Work
With—

McDougall

16 and 20 inch Crank

SHAPERS

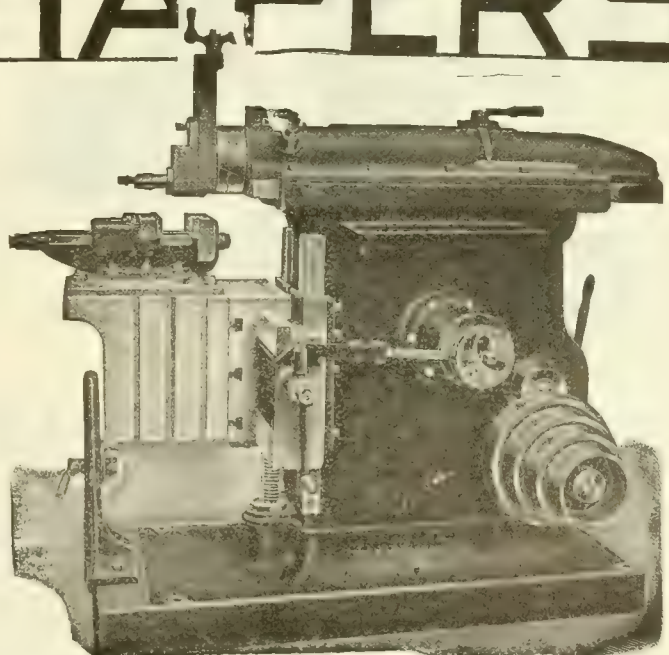
Modern methods of manufacture require modern tools. McDougall 16 and 20 inch Shapers embody the best features of all machines which have been placed upon the market and can be depended upon to produce work accurately and fast.

An important feature is the column. It is massive in construction, well braced and reinforced internally. Has ample opening under ram for keyseating or other long work. Bearings for ram extend beyond vertical line of column both front and back. The ram is of exceptionally strong construction.

McDougall shapers have other points of interest you should know about. Write for full description.

The R. McDougall Co., Limited
GALT, ONTARIO

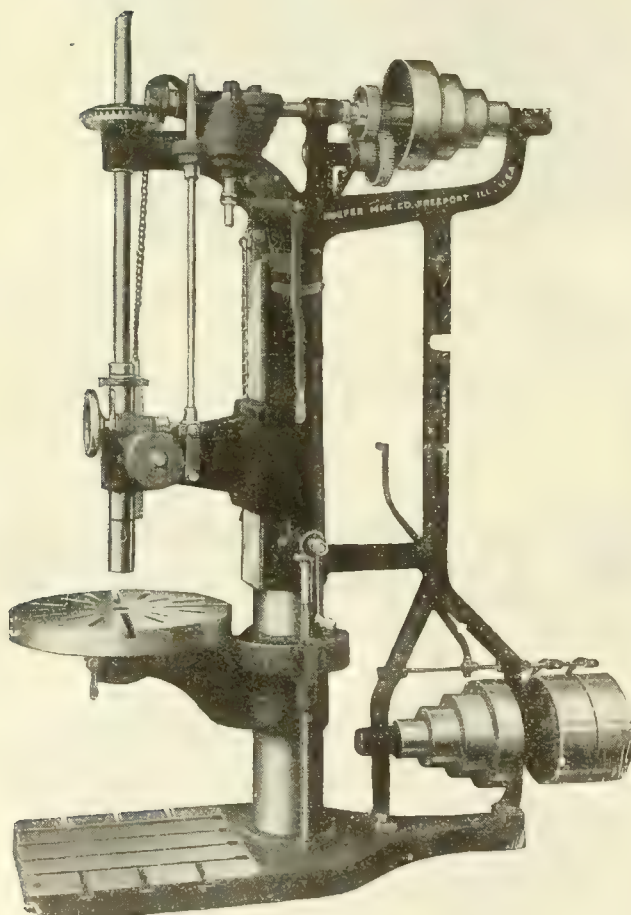
THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
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HOEFER

*the whole answer
to any hole question*



With HOEFER Drilling Equipment, your drilling department can easily be made to set the pace for the shop in speed, accuracy and economy. That's a broad statement to make, but hundreds of satisfied users can back it up and point to substantial figures of savings that we have effected with standard and special Hoefler Drillers. We were able to help these manufacturers by carefully studying their shops and their drilling jobs and then putting the present-day results of our twenty-five years of "know-how" to work at finding the best and most practical answer to their problems.

We may be able to show **you** possibilities of similar savings in **your** drilling operations, present or proposed. The chance is certainly worth the free consultation service that we offer. All you need do is to tell us what you are drilling and how you are drilling it or intend to drill it. We'll give you—without cost or obligation—authoritative advice as to the best way to do it. Write to our nearest sales agent or direct to the factory.

Send for the Hoefler Catalog.

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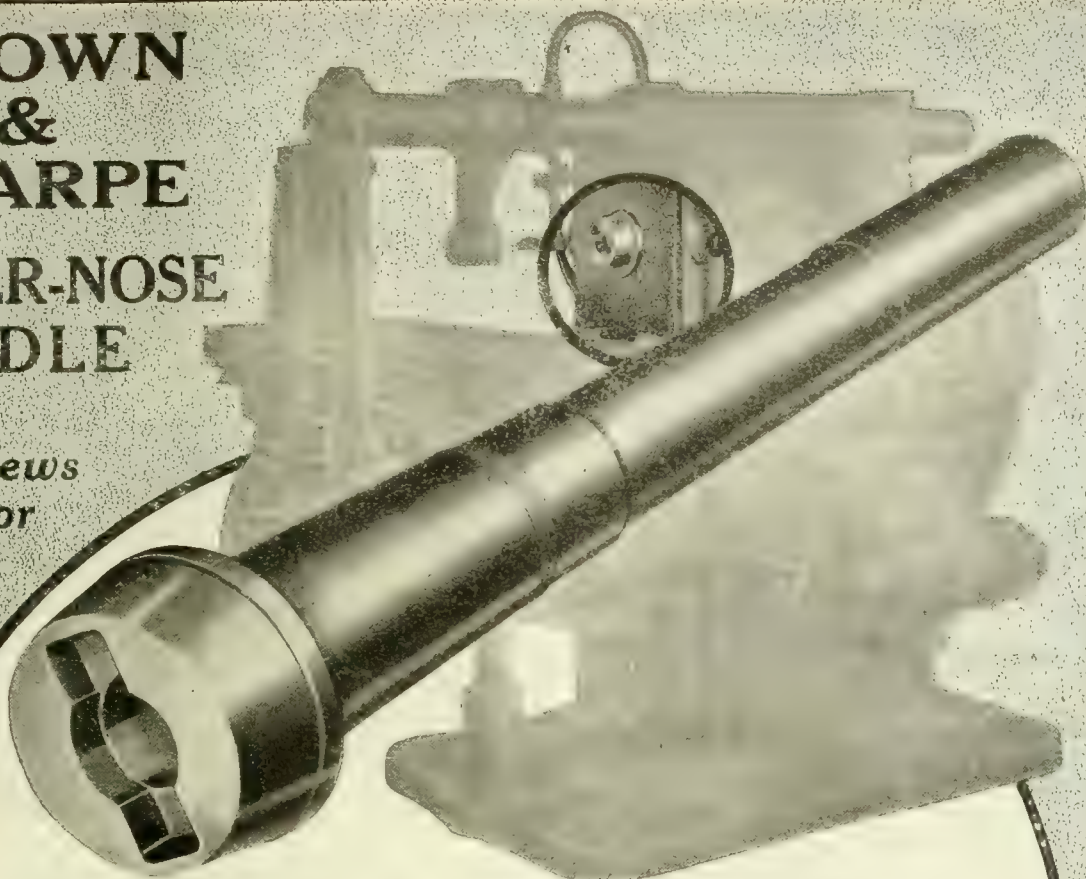
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*No Screws
Plates or
Loose
Parts*

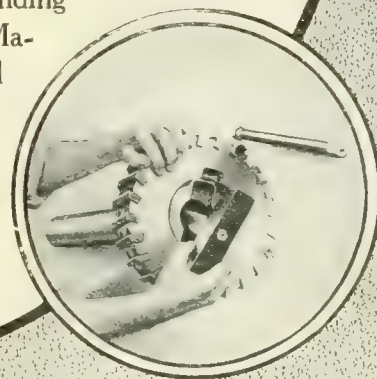
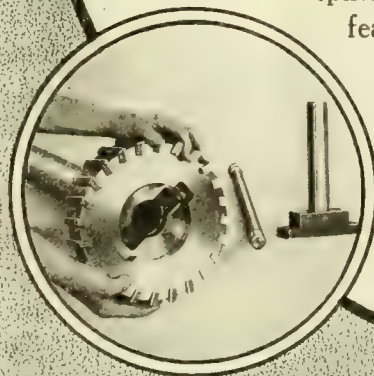


THE TAPER-NOSE SPINDLE . . .

assures a positive cutter drive under all conditions. The front end of spindle is tapered, hardened and ground and has a recess to receive cutter driver and clutch on arbors and collets. The ease with which face milling cutters are removed and replaced is particularly noteworthy—simply place cutter onto the taper nose of the spindle, insert cutter drive as shown in the illustration and tighten drawing-in-bolt. There are no plates, screws or loose parts used and when arbor, collet or cutter is in place it is essentially as firm as though a part of the spindle itself. This is one of the many outstanding features of Brown & Sharpe Milling Machines. For further information send for our Milling Machine Book.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R.I., U.S.A.

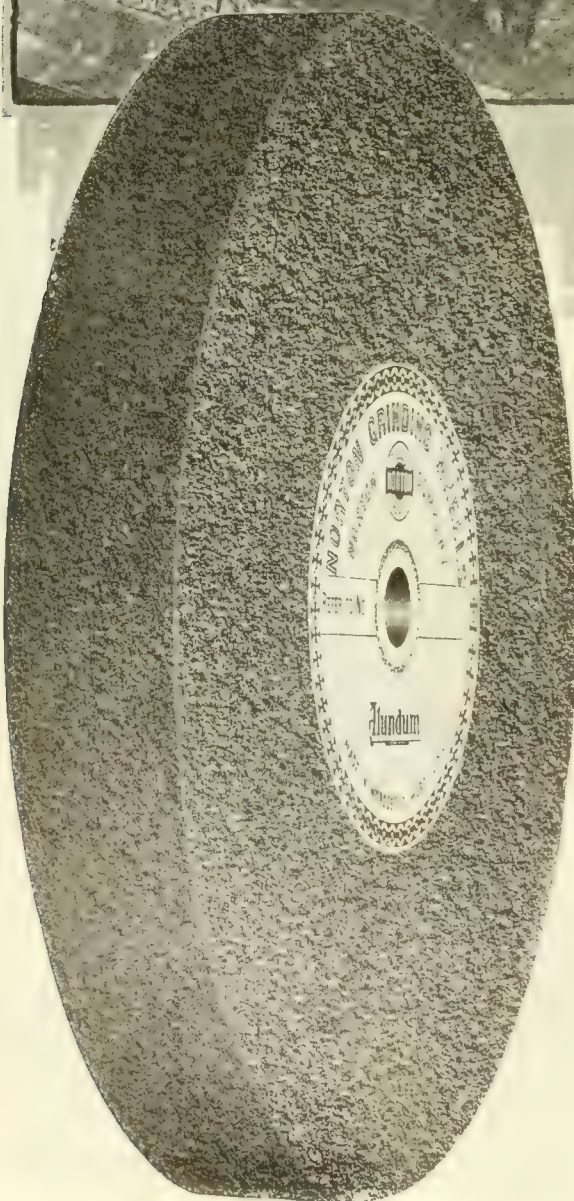
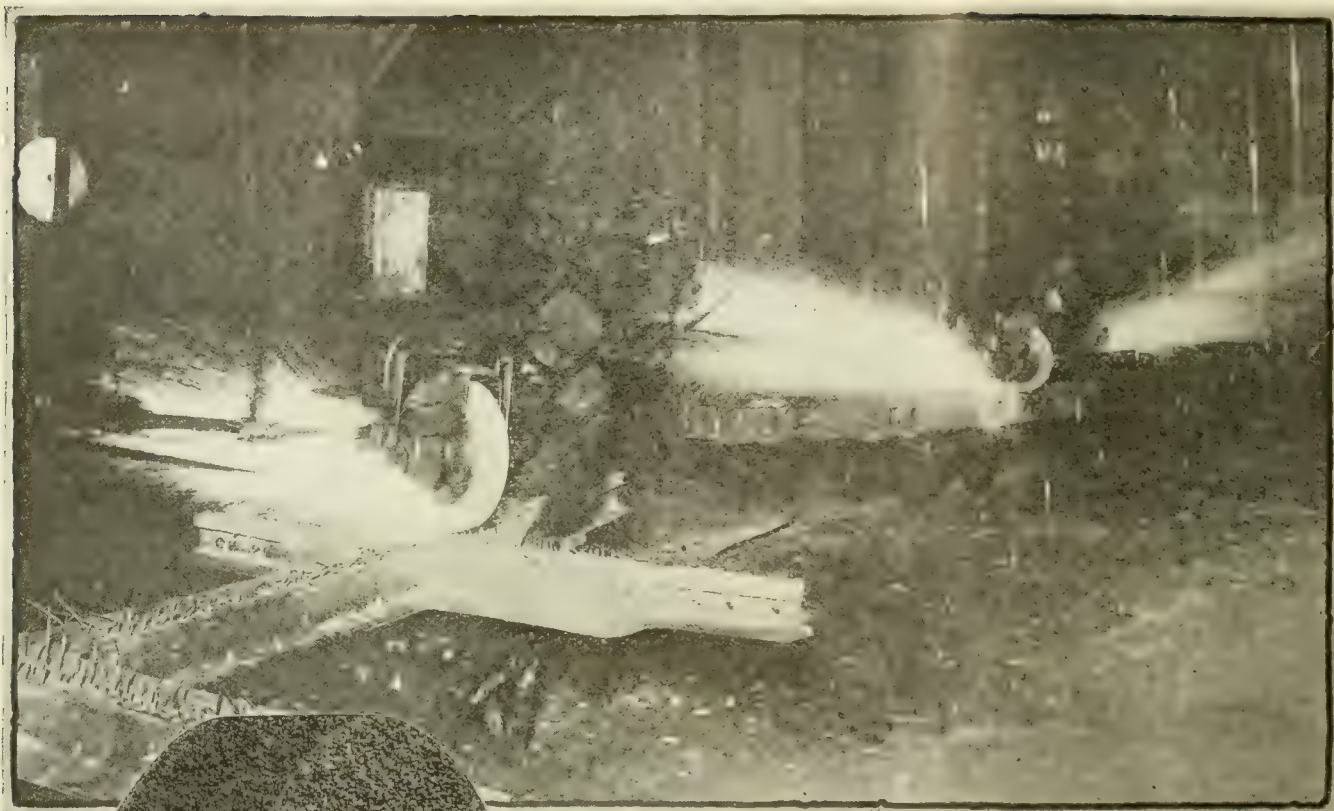
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CANADIAN FAIRBANKS-MORSE CO., Ltd.



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FOR THE TOOL ROOM

HEAVY PLAIN MACHINES
FOR THE MANUFACTURING FLOOR



ALUNDUM

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Tearing off fins and excess metal from giant castings is no difficult machining operation, but it is rough on the wheel doing this heavy foundry work.

ALUNDUM wheels **stand up** under the strain of hogging off metal. This artificial abrasive, known to the grinder as "Alundum," has no superior for fast and cool cutting.

The size of the wheel, the amount of material to be removed, and the nature of the material to be ground, readily determine the size of the grain.

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HAMILTON, ONTARIO

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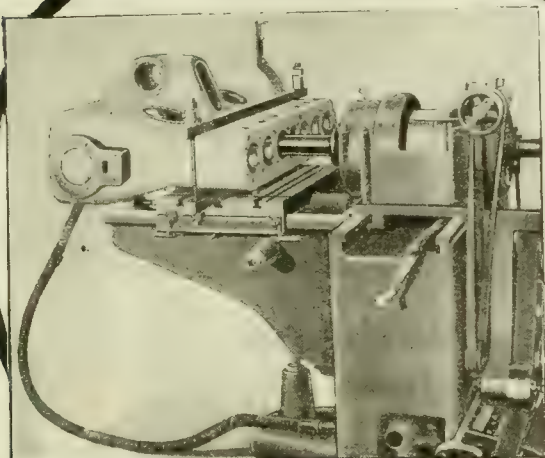
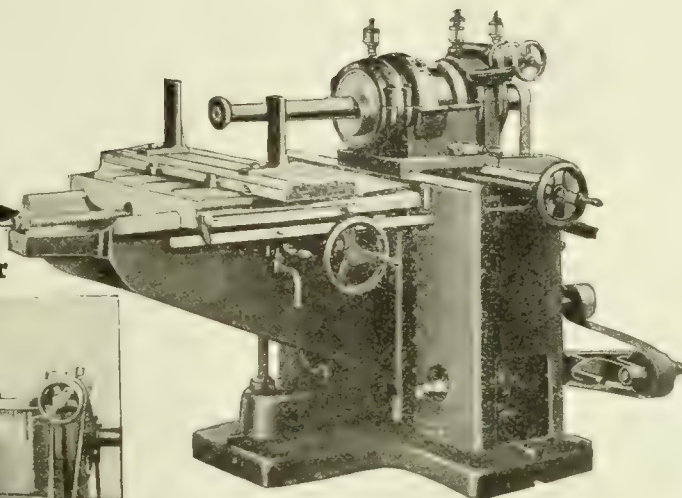
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ALUNDUM WHEELS for Steel and Steel Alloys

Re-grinding Cylinders at a Profit

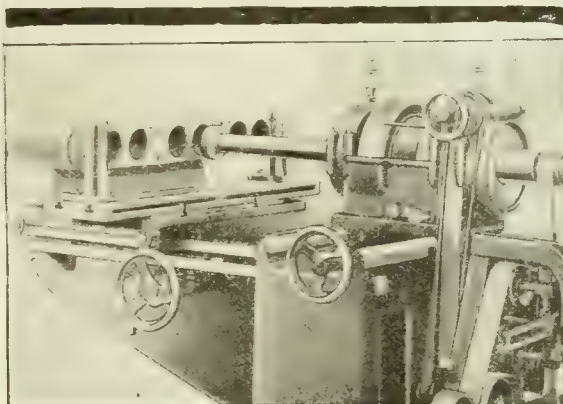
Are you equipped to handle the re-grinding of cylinders in the engines of the automobiles, trucks and tractors that need overhauling and rebuilding in your community?

**Madison
Cylinder Grinder**



Above: Regrinding an old Premier.

**At the Right: Regrinding
a Buick-6 Cylinder**



Add the profit of cylinder grinding to your automobile repairing and not only increase your profits considerably but make your customers boosters for you by putting power and life into their cars.

Put a Madison Cylinder Grinding Machine to work for you and do the gas engine cylinder re-grinding for all the repair shops in your vicinity.

Ask for the circular describing this machine—it will be sent you by return mail.

MADISON MACHINE TOOL COMPANY

1245 East Washington Avenue, Madison, Wisconsin, U. S. A.

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FAIRBANKS-MORSE



An Achievement in Mechanics

EACH individual department of The Canadian Fairbanks-Morse Company, Limited has given industrial Canada a new conception of achievement in mechanics. Each department has established a 100% quality and service standard. This is what enables Fairbanks valves to stand pre-eminent wherever valves are used.

When an engineer specifies Fairbanks valves, he knows that he has selected not only quality of material but workmanship that guarantees perfect operation.

He is satisfied with the reputation and service of the institution that stands behind them. He acknowledges an achievement in mechanics.

Wherever pipe lines are laid—in Canada's great industrial plants—in her immense water systems—in mines and mills—Fairbanks valves are giving a service that is marked by the 100% seal of quality, the standard of The Canadian Fairbanks-Morse Co. Limited.

Our nearest branch will give you the benefit of this service. Our experts will help you in selecting valves and everything mechanical that you require. Make our catalogue your buying guide.

The Canadian Fairbanks-Morse Co. Limited

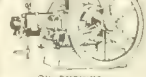
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CANADIAN MACHINERY

AND MANUFACTURING NEWS

OL. XXV. No. 5

February 3, 1921

Turret Lathe Applications

Careful planning of tool layout is necessary to ensure maximum production. The layouts, in this, the first of a series of articles on turret lathe practice, show how to machine a truck wheel, an automobile flywheel, and another flywheel of unusual design.

By J. H. Moore

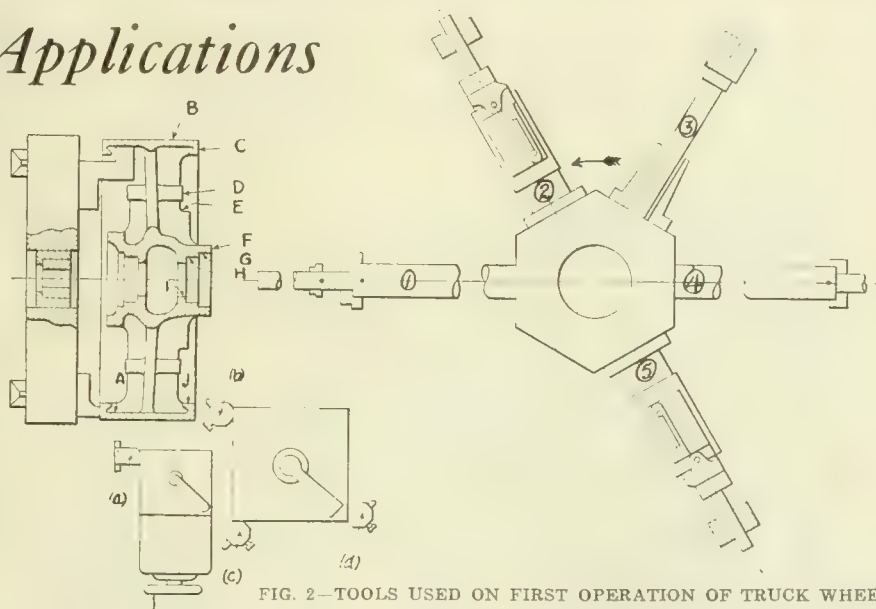


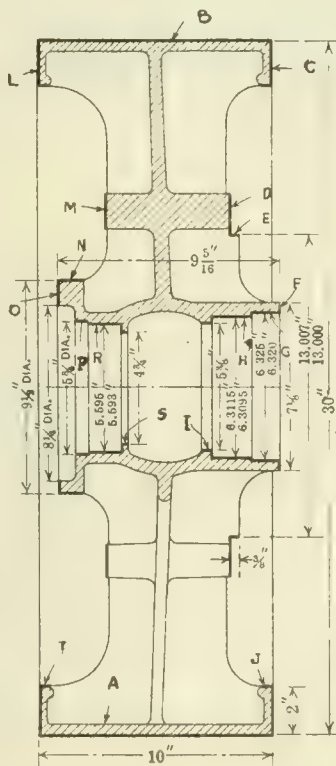
FIG. 2—TOOLS USED ON FIRST OPERATION OF TRUCK WHEEL.

THE subject of turret lathe work is always interesting, especially in these days when production is the cry. A turret lathe, irrespective of its design, cannot accomplish its best work if improperly tooled. It is therefore, perfectly safe to say that proper tool layout is just as important, if not more so, than the machine itself. A good machine can be rendered of very mediocre value by the use of poor tools.

Believing the readers of Canadian Machinery are interested in the subject of tool layout, we have prepared a series of articles, each complete in itself, dealing with this important matter. The information embodied in these articles was secured at the plant of the Gisholt Machine Tool Co., Madison, Wis., and deals with various parts produced on their machines.

Auto Truck Wheels

The first example is that of a truck wheel shown at Fig. 1. This view depicts the design of a rear wheel used on an automobile truck. The heavy lines indicate finished surfaces, that is, the surfaces finished in the turret lathe. This example is especially interesting, because the auxiliary tool post, commonly known as the wing rest tool post,



The surface H is now finish bored by a cutter held in position 4 of the turret, this bar being guided in the same manner as the bar already described.

The hole H is reamed out with the reamer in position 3 of the turret, and the surfaces E and F are rough turned by means of cutters held in the facing head at position 2 of the turret. The tool working on surface E is held in the top arm, and the tool machining F is held in the bottom arm of the facing head.

The surfaces E and F are next finished with tools held in the facing head at position 5 of the turret. This facing head is exactly similar to that used for the roughing operation.

Next come the surfaces C and D, these being finished with the tool (c), see auxiliary tool post. The inside of the rim at J is bored with the tool (d) also held in the auxiliary tool post. The total time for these various steps is 50 minutes.

Second Operation

We now come to the second step. This is shown clearly at Fig. 3, and the following steps are gone through. The work is held on a special chuck plate by means of clamps. The surfaces L, M, N, and O are rough machined with the tool (a) held in auxiliary tool post. The holes P, R, and S, are next rough bored with cutters held in position 1 of the turret. This bar has a pilot which is guided in a bushing mounted in the chuck plate.

The hole is now finish bored with the cutter held in boring bar at position 2 of the turret, this bar being piloted as stated previously. This same hole is next reamed with a reamer mounted at position 3 of the turret. A second roughing cut is now taken over the outside of the wheel by means of tool held in the auxiliary tool post, this cut being followed by the facing head mounted at position 5 of the turret. This head finishes the outside of the rim also the surfaces N and O. The three tools ne-

cessary to complete this work are mounted in the top, rear, and bottom arm of head respectively.

While this operation takes place, the facing head is guided by means of a bushing on its pilot which enters the hole R. The surfaces I and M are next finished with the tool (b) in auxiliary tool post. The inside of rim is now bored with the tool (c) in tool post. The total time required for these steps is 45 minutes.

Figs. 4 and 5 show up to good advantage the two operations in photographic form. The auxiliary tool post is plainly seen in each case, and as the steps have already been described in detail we need not dwell on these views.

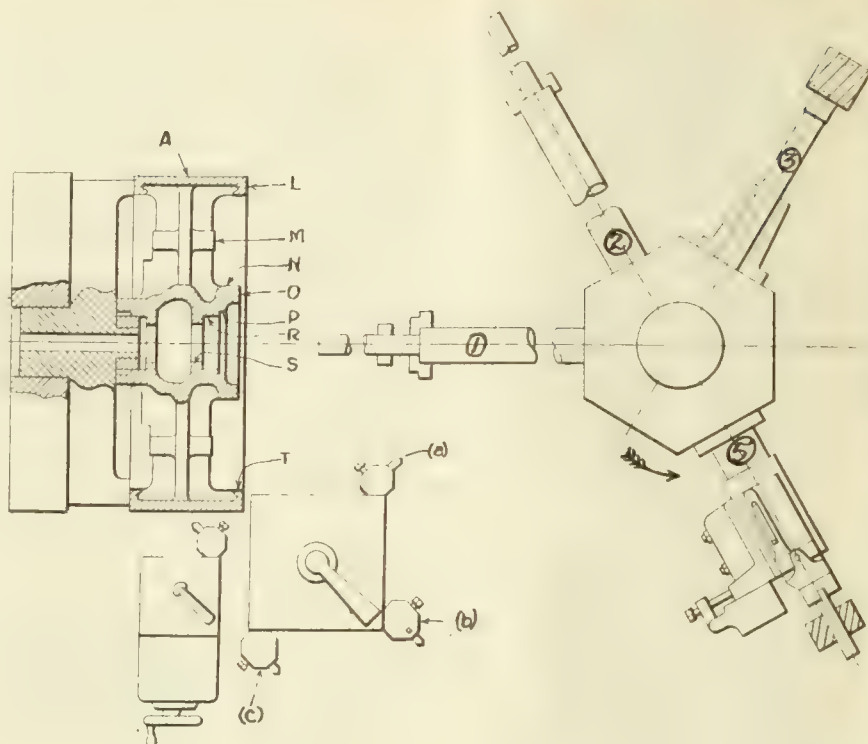


FIG. 3—SECOND OPERATION ON THE WHEEL SHOWN AT FIG. 1.

Automobile Flywheel

The next example of work performed is shown at Fig. 6. This represents an automobile flywheel made of semi-steel, on which the sections are rather thin. In finishing this piece, three operations in place of two are necessary, as a great amount of stock has to be removed. As the sections are very light considerable distortion would result if all the stock was removed at once on each side of the wheel. In a case of this kind it is good policy to have one, or even more extra operations, rather than allow distortion.

First Operation

The first operation consists of roughing one side. The other side is roughed

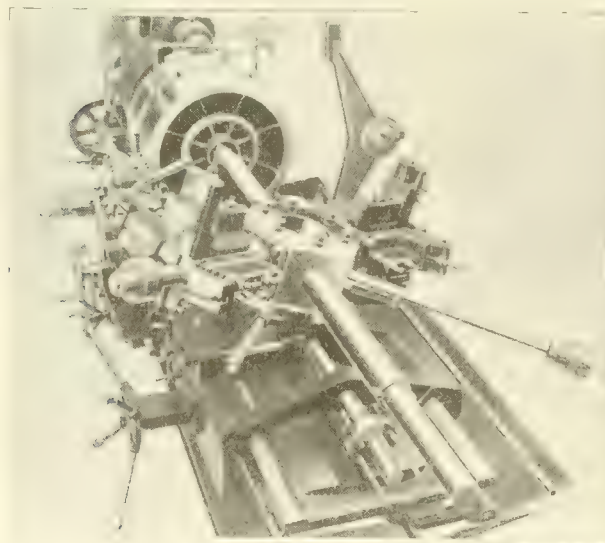


FIG. 4—TOP VIEW OF EQUIPMENT USED ON THE FIRST OPERATION OF TRUCK WHEEL SHOWN AT FIG. 1.

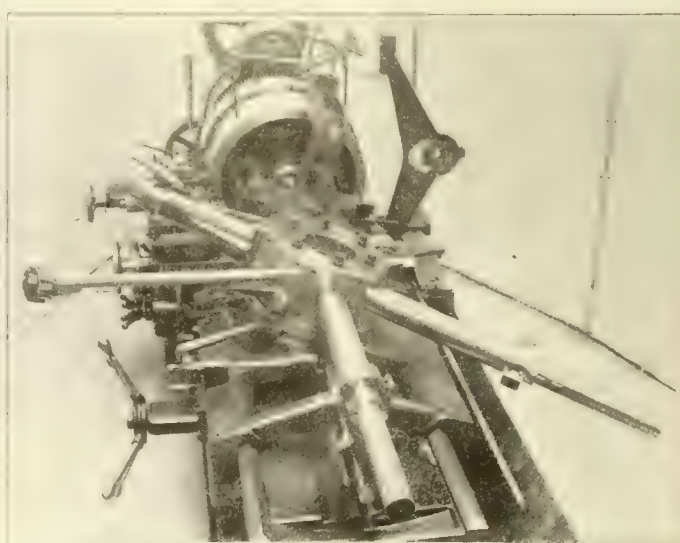


FIG. 5—A SIMILAR VIEW SHOWING THE TOOLS USED ON THE SECOND OPERATION OF THE TRUCK WHEEL.

and finished in the second operation, while the flywheel is rechucked in the third operation, and the first side, which was only roughed, is next finished. Fig. 1 illustrates the tool layout for the first operation. The rough turned flywheel, and the method employed to hold the same is shown at Fig. 8. Following are the steps in the first operation.

The work is held in special hardened chuck jaws, and the bottom A is rough turned with tool B in tool post, and the hole is bored with the cutter mounted at position 1 of the turret. The inside and outside surfaces C and D are next bored and turned respectively, with the facing tool mounted at position 3 of the turret. The head shown at position 6 of the turret is now used, but is merely mounted to balance the turret.

The surfaces E, F, and G are now rough faced with the tool H in the tool post. This first operation is completed in 8 minutes.

Second Operation

The work is held in the second operation as shown at Fig. 9. At this operation the one side of the flywheel is roughed and finished complete, and the steps performed are as follows. The work is held in special jaws as indicated, and chuck jaws are used to support it against the surface A. The surfaces I, J, K, L, and M, also the bottom of the counter-bore N are rough faced by the tool O in the tool post.

After this is accomplished the bore and counterbore N are rough bored with cutters in the bar mounted at position 1 of the turret. This same bore and counterbore is now finished with the cutters in bar mounted at position 2 of the turret. The bars used in these steps are provided with pilots that enter into bushing in the chuck.

The bore P is next reamed with the reamer mounted in position 4 of the turret, after which the outside surface

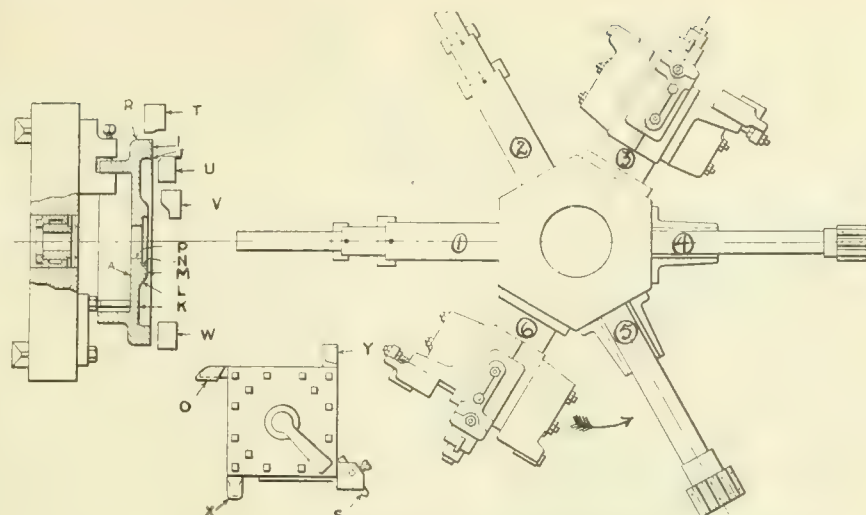


FIG. 9—LAYOUT OF TOOLS FOR SECOND OPERATION ON THE FLYWHEEL SHOWN AT FIG. 6.

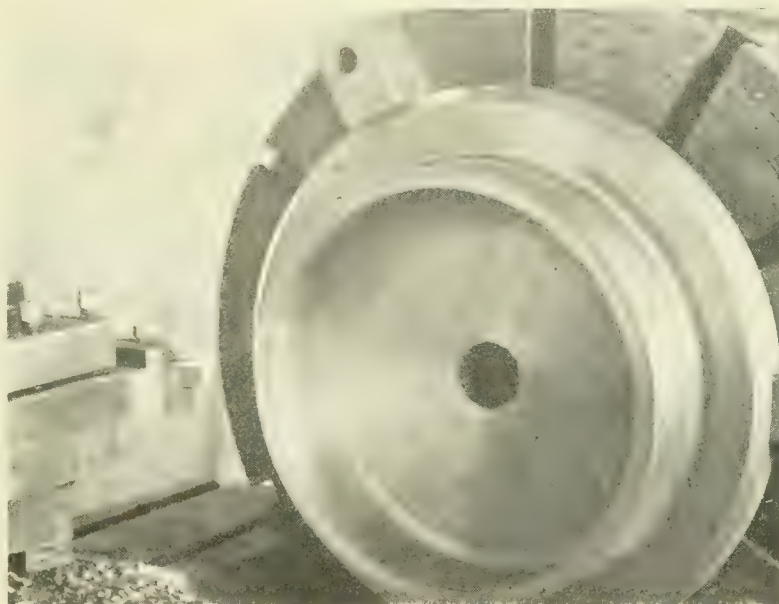


FIG. 8 SHOWING THE METHOD OF HOLDING FLYWHEEL IN THE FIRST OPERATION.

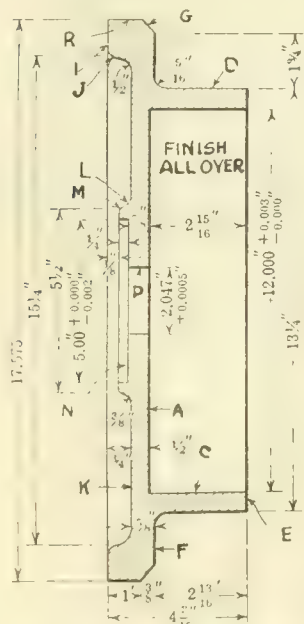


FIG. 6 DETAILS OF THE AUTOMOBILE FLYWHEEL.

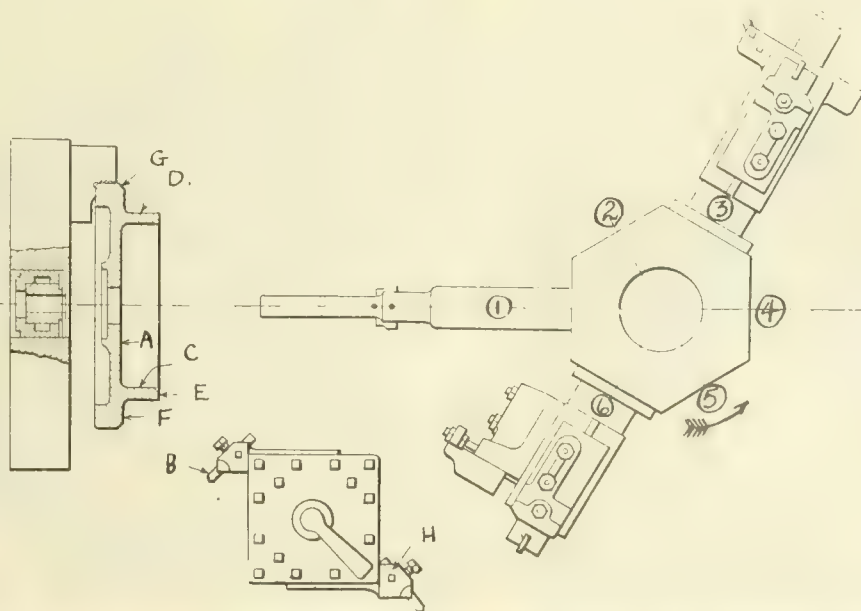


FIG. 7 LAYOUT OF TOOLS FOR THE FIRST OPERATION ON THE FLYWHEEL SHOWN AT FIG. 6.

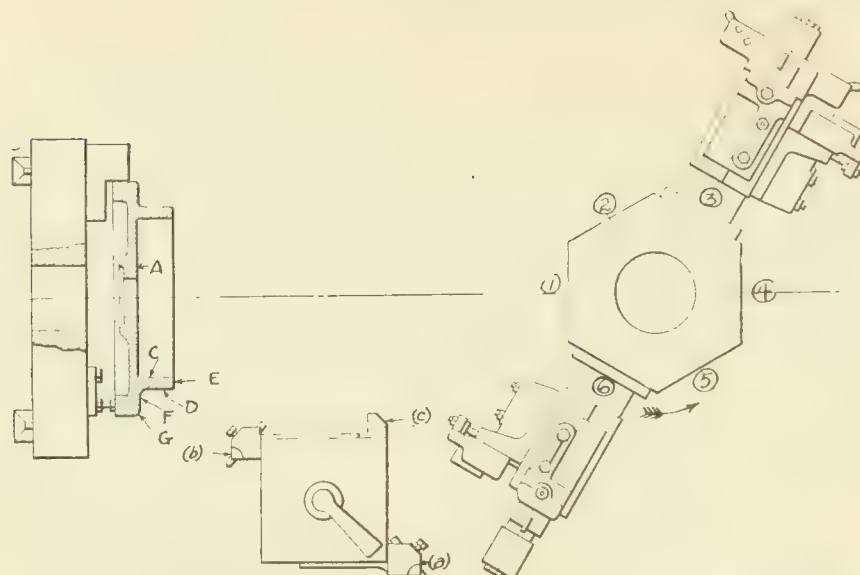


FIG. 10—LAYOUT OF TOOLS FOR THE THIRD OPERATION ON THE FLYWHEEL.

R is rough turned with tool S mounted in the tool post. This tool is followed by the facing head mounted in position 3 of the turret. This head roughs the surfaces R, I, J, and M. The facing head is provided with a pilot entering the bore of the flywheel. The tool T which turns the surface R is held in the top arm, while the cutter U is held in the front arm of facing head. The cutter V is held in the bottom arm, and cutter W in the rear arm of the same head.

The surfaces R, I, J, and M are now finished by the tools of similar nature. The surfaces K and I are finally completed by means of tool X held in the tool post. The bottom of the counterbore N is finished by tool Y held in the tool post. The cylindrical surface of the counterbore N is finished by reaming with the

reamer shown at position 5 of the turret. The total time for this second operation is 10 minutes.

Third Operation

Fig. 10 depicts the third and last operation on this piece. This work consists of finishing the already rough finished side of the wheel. The work is followed out in this manner. The flywheel is held with soft jaws, and is supported by means of chuck jacks. The outside of the cylindrical surface D, and the face F are rough faced by the tool (a) in the tool post.

The surfaces C and E are rough machined, and the surfaces D and F are finished with tools in facing head at position 3 of the turret. This facing head is piloted in the bore of the flywheel. The bottom A is finish faced with tool (b) in the tool post, after which the surfaces C and E are finished with cutters held in the facing head at position 6 of the turret. It will be noted that these tools are directly opposite, this being, of course, to balance up the turret.

The chamber G is finished with tool C in the tool post, and the total time for this, the final operation is ten minutes. This makes a total of 28 minutes for the three operations.

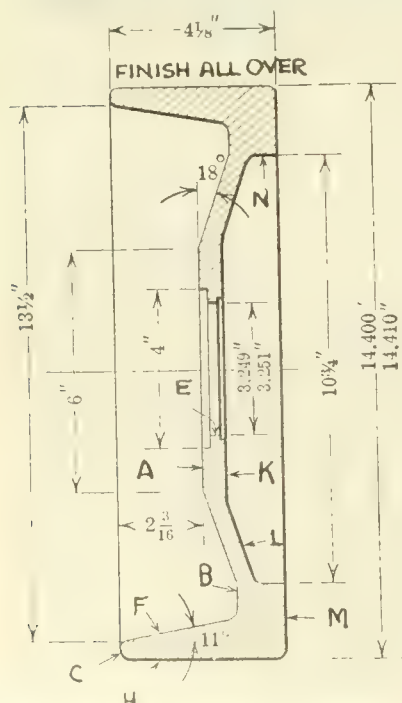


FIG. 11—A FLYWHEEL OF RATHER UNUSUAL DESIGN.

Flywheel of Unusual Design

The remaining example in the present article is shown at Fig. 13. This view depicts another flywheel, but one which has a most unusual design. It will be noted that this wheel has central web part of which is at an angle with the axis of the flywheel. The material is cast iron, and the wheel is finished over on a 24 inch turret lathe in two operations.

The first operation consists of roughing and finishing the convex side of the web, the beveled inside surface, and the outside of the rim. Fig. 14 illustrates the tool layout for the first position. The work is held by the inside of rim by means of special chuck jaws. The surfaces A, B and C are roughed with the tool D in the tool post. The hole E is next bored, and the surface A is finished with tools mounted in position 1 of the turret. The tool is guided by a pilot which enters a bushing in the chuck.

The hole E is now reamed with the reamer held at position 3 of the turret. The bevelled surface F is next rough bored with the tool in the facing head at position 4 of the turret. Simultaneously with this operation, the outside H of the wheel is rough turned with the tool G in the tool post. The beveled surface F is now finished with the tool held in the facing head at position 2 of the turret.

Following this step the surfaces C and B are machined, and the corners of surfaces C are chamfered with the tool at position 5 of the turret. The facing head used for this work can be clearly noted in the photograph shown at Fig. 16. This tool is specially designed to finish the tapered surface F with a single point tool. In this way the angle is bound to be correct. In action here is what occurs: A pilot enters the bore of the flywheel, and a flange is provided with a ball thrust bearing which bears against the web of the wheel at C. This locates the tool accurately, and prevents the pilot from entering beyond a certain point. The head then slides over the pilot, and as the head is provided with a pin that rests against a tapered surface immediately beyond the thrust bearing, the tool in the facing head is lowered as it slides forward, thus ensuring that it will finish the surface ac-

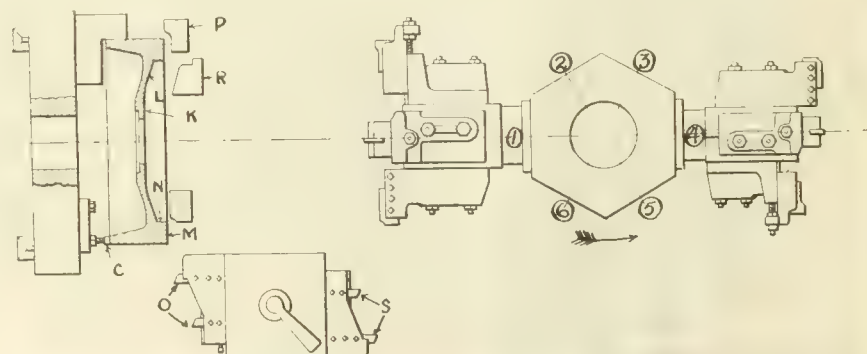


FIG. 12. THE TOOLS USED ON SECOND OPERATION ON FLYWHEEL SHOWN AT FIG. 13.

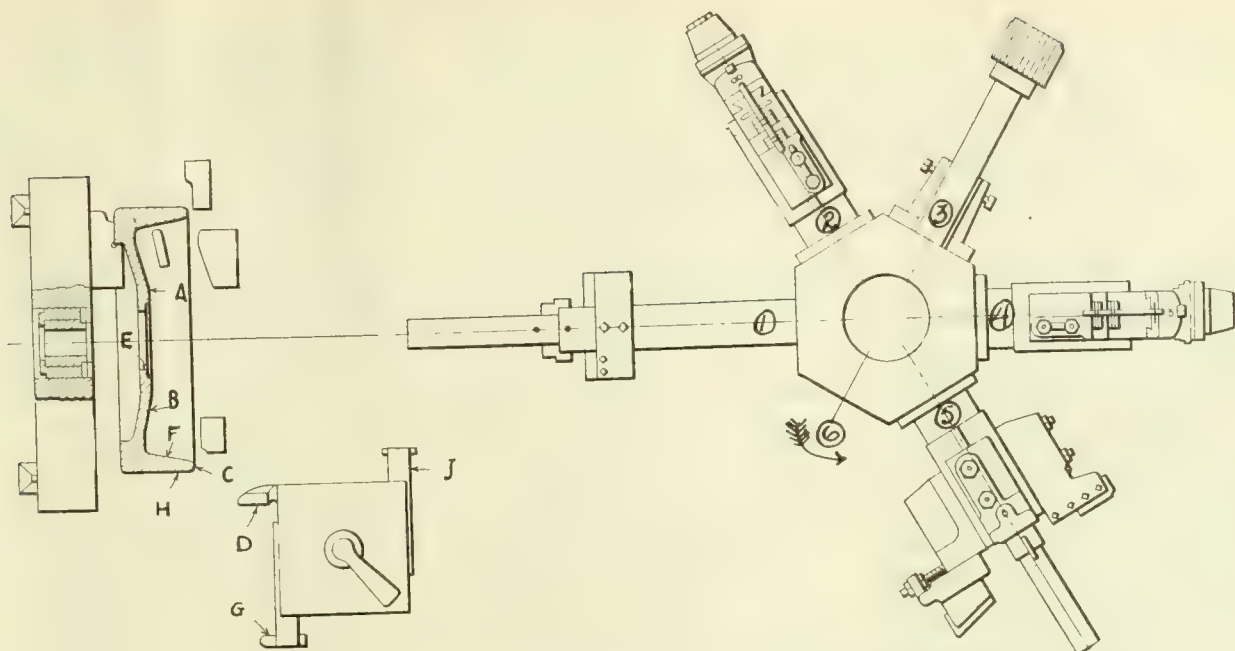


FIG. 14. TOOLING USED FOR THE FIRST OPERATION ON THE FLYWHEEL SHOWN AT FIG. 13.

curately. The last step in the first operation consists of finishing the outside surface H with the tool J in the tool post.

Second Operation

The second operation is shown at Fig. 15. This consists of roughing and finishing the concave side of the fly wheel, and the method employed is as follows. The work is held in soft chuck jaws which bear against the finished outside surface of the flywheel. It is also supported by means of chuck jacks which bear against the rim at C.

The surfaces K, L, and M are now rough faced with tools held at O in the tool post. The surface N is next rough bored, and the surface L is rough faced. The outside corner at N is also rounded with tools held in the facing

head at position 1 of the turret. The surfaces N and L are now finished, and the inside corner of N is rounded with the tools held in head at position 4 of the turret. In both the third and fourth steps, the facing heads are piloted in the bore of the flywheel. The tool P is held in the rear arm of facing head, while the other R is held in the top arm. The last step is that of finishing the surfaces K and M by means of the tool S in the tool post. Fig. 17 depicts the second operation, as viewed from the front of the machine.

This completes the present article. In a later issue we will show further examples of work performed on these styles of lathes.

PROPERTIES OF METALS

An investigation into the properties of white metals for bearings has recently been carried out by the Bureau of Standards. It was found that tin-base alloys maintain their strength properties better at elevated temperatures than do those containing lead. However, the yield point or ultimate strength of a high-grade babbitt at either 25 deg. or 75 deg. Cent. is not affected by lead admixtures up to 3 per cent. Prolonged heating lowers the strength of lead-base alloys much more seriously than it does that of tin-base alloys. The yield point of a tin-base alloy was not affected by heating for six weeks at about 100 deg. Cent., but the yield point of a lead-base alloy was lowered by only two weeks' heating at the same temperature.

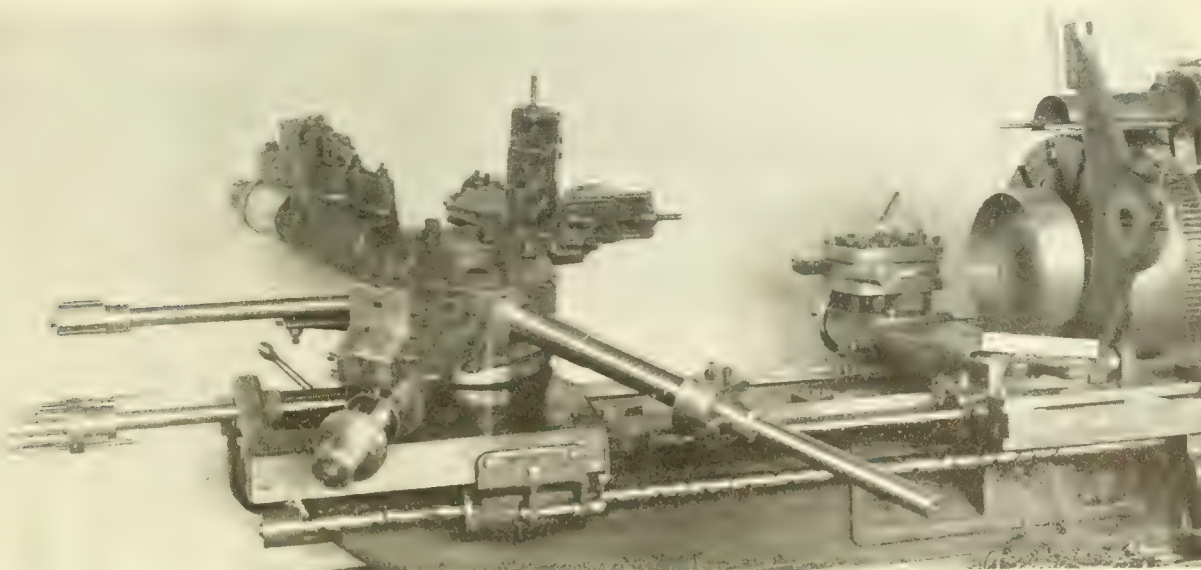


FIG. 17. THE SET UP FOR FIRST OPERATION ON FLYWHEEL SHOWN AT FIG. 13. THIS VIEW IS TAKEN FROM THE REAR.

The Side-Cutting of Thread Milling Hobs

The Hobbing of Screws, Interference Due to Helix, and Other Important Formulae—Points Out the Corrections in the Form of Thread Milling Hobs Which Can Readily Be Made

By E. BUCKINGHAM

WHEN a thread is chased in a lathe and the cutting tool has proper clearance and is set so that the plane of the cutting edges contains the axis of the thread, the exact form of the tool will be duplicated on the work. Assuming that the thread is completed, if the tool in its cutting position is brought into contact with the flanks of the thread, it will have a line bearing only. If sufficient clearance can be provided on the tool, this holds true regardless of the pitch of the thread, the angle of the flanks, or its diameter.

When a thread is hobbled, however, the axis of the hob being parallel to the axis of the thread, the path of any one cutting point is a circle, and this circle will interfere with the helix of the thread to an amount depending upon the pitch of the thread, the angle of the flanks, and the diameters of both hob and thread.

It is assumed in this discussion that the cutting teeth of the hob are backed off sufficiently to prevent any dragging of the relieved portion of the tool on the work. The interference between the cutting edge of the hob and the helix of the thread therefore results in the removal of additional metal, thus distorting the form of the thread. The amount of this distortion varies as the values of any of the following factors change: the pitch of the thread, the form of the thread, the diameter of the work, and the diameter of the hob.

*The author is Engineer of Standards for Niles-Bement-Pond Co., and Pratt & Whitney Co. He is an associate member A.S.M.E. This is an abstract of his paper presented at the annual meeting, New York, of the American Society of Mechanical Engineers.

It will be shown that correction for some of this distortion inevitable with this method of manufacture is impossible. The amount of this distortion, however, can be reduced in many cases by the proper relation between the diameters of work and hob. It will also be shown that most of the distortion can be corrected by a suitable alteration in the form of the cutting tool.

The Hobbing of Screws

In Fig. 1, which shows a diagram of a hob and screws, let

R = radius of any cutting point on the hob

r = radius of deepest point on work touched by R

N = number of threads per inch

A = angle of rotation of hob

B = angle of point of contact of R at angle A

C = $\frac{1}{2}$ included angle of thread

r' = radius of point of contact on R on work.

Formulas will first be derived to show the interference between the path of any cutting point on the hob and the flanks of the thread and for purposes of plotting the radial distance of the cutting point R from the deepest point on the work touched by R will be designated as y . In other words,

$$y = r' - r \quad \dots \dots \dots (1)$$

The longitudinal (or axial) distance R of the cutting point from the flank of the theoretical thread will be designated by x . A plus value of x will indicate a clearance, while a minus value will indicate an interference or side-cutting.

In order to determine the value of y

the triangle shown in heavy lines in Fig. 1 must be solved. The known factors will be taken as r , R and B . We first have

$$\frac{(R+r) \sin B}{R} = \sin 180^\circ - (A+B)$$

$$\sin 180^\circ - (A+B) = \sin (A+B)$$

$$\frac{(R+r) \sin B}{R} = \sin (A+B) \dots (2)$$

From this equation we determine the value of A . Solving the triangle for r' , we have

$$\frac{R \sin A}{\sin B} = r' \quad \dots \dots \dots (3)$$

and when the value of r' is determined, the value of y is established from Equation [1].

As the hob revolves away from the common center line of the hob and work, the cutting points on one side of the tooth of the hob, due to the helix of the thread, will have a clearance with the flank of the thread, while the cutting points on the other side of the tooth of the hob will develop an interference. But the side of the hob which clears the helix as the cutting point revolves away from the common center line will interfere as the cutting points approach to the common center line, and the nature and extent of this interference will be symmetrical and equal on both flanks of the thread is symmetrical.

The amount of interference depends upon the value of B and the pitch of the thread, or number of threads per inch, N . Thus

$$\text{Interference Due to Helix} = \frac{B}{360N} \dots \dots \dots (4)$$

If the included angle of the flanks of the thread is greater than zero (which is the case for all but square threads), as the cutting point of the side of the cutting tooth departs from the common

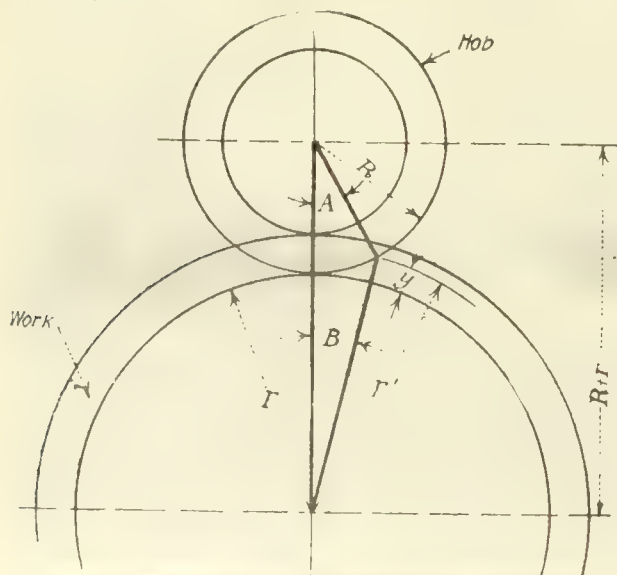


FIG. 1. DIAGRAM OF HOB AND EXTERNAL SCREW

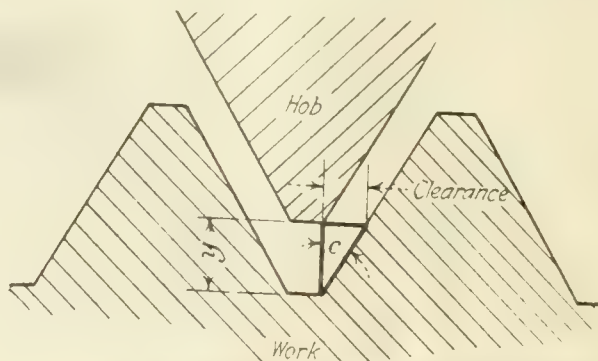


FIG. 2. DIAGRAM SHOWING CLEARANCE BETWEEN HOB AND WORK.

centre line of the hob and work a clearance develops between the cutting point on the hob and the flanks of the thread. The amount of this clearance depends upon the value of y and the included angle of the thread, and referring to Fig. 2 it will be seen that its value, ignoring for the present the helix of the thread, may be expressed as:

$$\text{Clearance} = y \tan C \dots \dots \dots [5]$$

The value of x is therefore found by subtracting the amount of interference given by Equation (4) from the amount of clearance given by Equation (5), or

$$x = y \tan C - \frac{B}{360N} \dots \dots \dots (6)$$

As an example of the use of the above formulae, we will assume that we wish to hob a thread which has a radius r or 0.5625 in. at the minor diameter with a hob whose radius R is 2.250 in. at its outside diameter with 4 threads per inch. A thread with a relatively large helix angle is taken as the first example in order to show the nature of the resulting side-cutting of a hob. The thread has an included angle of 60 deg., making $C=30$ deg., and $N=4$. The value of B is taken from 0 deg. to 12 deg., which gives the following values for x and y :

For $B = 0^\circ$	2°	4°	6°	8°	10°	12°
$x = 0$	-0.00114	-0.00176	-0.00194	-0.00157	-0.00064	-0.00084
$y = 0$	0.00043	0.00176	0.00386	0.00691	0.01092	0.01589

The above as well as intermediate values are plotted in Fig. 3-A at the left, and the actual path of the cutting point is shown at the right. These curves show the general form of the side-cutting of any point on the cutting face of a thread hob.

This cutting face of the hob is made up of an infinite number of points. As the positions of these points vary, the ratio between R and r varies, as also does the helix angle of the thread, and therefore each cutting point travels in a different form of path. Thus, in order to determine the resulting form of a thread cut with a hob it will be necessary to plot the paths of a few other points. A point 0.20 in. higher on the flank of the thread will therefore next be taken. This gives $R=2.050$, and $r=0.7625$, as before, $C=30$ deg. and $N=4$, and the values for x and y with these factors are as follows:

For $B = 0$	1	3°	5°	7°	9°
$x = 0$	-0.00061	-0.00126	-0.00117	-0.00032	-0.00136
$y = 0$	0.00015	0.00143	0.00398	0.00786	0.01318

These values are plotted at the left in Fig. 3-B. The actual path of the cutting point is shown at the right.

A third point 0.40 in. above the bottom of the thread will also be taken. This point is beyond the top of the thread, but it is taken to accentuate the distortion developed by hobbing. In this case $R=1.85$, $r=0.9625$, $C=30$ deg.,

and $N=4$. The values for x and y with these factors are as follows:

For $B = 0^\circ$	1°	3°	5°	7°
$x =$	-0.00057	-0.00093	-0.00026	-0.00151
$y = 0$	0.00022	0.00199	0.00566	0.01104

The above values are plotted at the left in Fig. 3-C. The actual path of the cutting point is shown at the right.

In order to show more clearly the nature of the side-cutting of hobs, the curve in Fig. 4 is plotted in an exaggerated form with the intervals along the y -axis equal to 0.001 in., and those along the x -axis equal to 0.0001 in. The curves shown in Figs. 3-A, 3-B and 3-C are plotted to this scale and brought together proportionately; that is, the origins of these curves are spaced equally from the bottom, but these spaces are not to scale. This distorts still further the exact shape of the curve, but its

general properties are quite correct.

This curve shows the general nature of the distortion in the form of a thread which is caused by the side-cutting of

smaller in diameter. On the other hand, the distortion shown in the upper part

of the curve can be eliminated by changing the form of the cutting edge on the hob.

The correction of the hob is determined in the following manner: The greatest amount of side-cutting is done by the bottom corner of the hob. In the foregoing example the tabulation shows 0.00194 in. when $B=6$ deg. This is not necessarily the exact maximum. If a closer value is required, the tabulations must be made with increments of B of smaller amounts. Tabulations as shown, however, will be correct to the fourth decimal place, which is sufficiently accurate for most purposes.

If the tooth of the hob is narrowed at each point of the cutting edge by the amount which it side-cuts the thread form, the contour of the thread above the line A-A in Fig. 4 will be correct and in most cases it will be found that the correction in a straight line will be

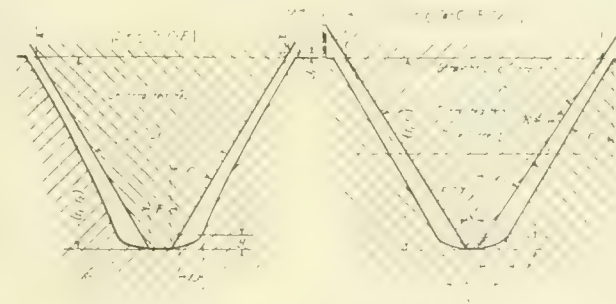


FIG. 5. FORM OF EXTERNAL THREAD CUT WITH UNCORRECTED AND CORRECTED HOB.

the hob. It will be noted that it is a double curve, the lower part (below the line A-A) being developed by the bottom corner of the hob tooth while the

upper part (above the line A-A) is developed by the overlapping paths of successive cutting points on the cutting face of the hob. It is evident that the distortion shown at the bottom of the curve is inevitable and no correction in the form of the hob is possible that will eliminate it. It can be reduced in many cases, however, by making the hob

sufficiently accurate as the resulting error will be negligible.

Fig. 5-A represents the form of a thread cut with a hob having the form of the cutting edges identical with the true form of the thread. In this figure,

C =half included angle of thread
 F =width of flat of thread at the root or minor diam.

r_1 =largest value of r employed (radius of major diam.)

r_2 =smallest value of r employed (radius of minor diam.)

x_1 =maximum minus value of x for r_1

x_2 =maximum minus value of x for r_2

$(r_1 - r_2) = \text{depth of thread}$

$2(r_1 - r_2) \tan C + F = \text{width of space at major diameter (outside).}$

Fig. 5-B illustrates a corrected hob and the form of thread cut with it. In this figure,

$F - 2x_2 = \text{width of flat at bottom of hob form}$

$2(r_2 - r_1) \tan C + (F - 2x_1) = \text{thickness of hob form at top.}$

$C' = \text{half the included angle of corrected hob.}$

If the cutting edge of the hob is kept as a straight line, the tangent of half the included angle of the hob form will be equal to half the difference between the widths of hob form at the top and bottom divided by the height of the form. Using the values shown in Fig. 5-B, we have the following:

$$\begin{aligned} \tan C' &= \frac{2(r_1 - r_2) \tan C + (F - 2x_1) - (F - 2x_2)}{2(r_1 - r_2)} \\ \tan C' &= \tan C + \frac{F - 2x_1 - F + 2x_2}{2(r_1 - r_2)} \\ \tan C' &= \tan C + \frac{x_2 - x_1}{r_1 - r_2} \dots \dots \dots (7) \end{aligned}$$

It will be seen from Equation [7] and also from the figures that a corrected hob will have a greater included angle than the thread itself; or, in other words, the included angle of a hobbled thread on a screw or male-threaded part will be less than the included angle of the hob.

The dotted line in Fig. 5-B represents the true correction of the hob. Also in this figure,

$r = \text{value of } r \text{ at middle of thread flank (or at pitch diameter)}$

$x = \text{maximum minus value of } x \text{ for } r_2$

$K = \text{difference at } r_1 \text{ between straight-line correction on hob and true correction.}$

$$\frac{x_2 - x_1}{2} + x_1 - \frac{x_2 - x_1 + 2x_1}{2} - \frac{x_2 + x_1}{2}$$

$= \text{correction at } r_1 \text{ when hob form remains a straight line.}$

$$K = \frac{x_1 + x_2 - x}{2} \dots \dots \dots (8)$$

If the rounding or fillet at the bottom of the thread as shown in Fig. 5-B is objectionable, the point of the hob may be extended by an amount about equal to y_2 , provided that such an undercut is permissible. By so doing an almost theoretically perfect thread form will be secured. Theoretically, the point should extend slightly more than y_2 , as at this point r becomes smaller and R becomes larger than the values of r_1 and R_1 . Re-

ferring to Equation [3], this increase in the value of R will increase the value of r' . Referring to Equation [1], this increase in the value of r' and the decrease in the value of r will increase the value of y . But for all practical purposes an extension on the point of the hob of the nearest even dimension to y_2 will usually be sufficiently accurate. On standard threads cut with hobs the resulting error will be in fifth or sixth decimal place.

For the purpose of simplifying calculations tables have been developed which are given in the complete paper. These tables are based on work whose radius is 1.000. The value of $B/360$ is given opposite varying values of B and values of y/r are given for different values of r/R . In order to use the tables the value of r/R must first be determined, then the value of y/r is multiplied by the radius of the work to obtain the value

are divided by N and substituted in the equation $x = y \times \tan C - (B/360N)$ to obtain the value of x .

In order to illustrate the use of these tables and to determine the effect of carrying the diameter of the hob, values are given in the complete paper for an Acme thread (5 threads per inch, one inch in outside diameter) cut with three hobs, the first one inch in diameter, the second two inches in diameter, and the third four inches in diameter. An Acme thread is selected because the smaller included angle of thread results in more side-cutting, thus making more pronounced the effect of varying the diameter of the hob. The depth of an Acme thread of this pitch is 0.110 in. The included angle is 29 deg. The width of the flat at the root of the thread is 0.0689 in.

The final value of the included angle, $2C'$, is given by Equation [7] is found to be $29^\circ 59' 26''$, and in the particular case chosen the difference between the angle of the hob and angle of the work is 59 min. 26 sec. The correction is therefore made in a straight line. By means of Equation [8] the difference K between this correction and the true correction at the middle of the flank is also determined as 0.000064 in. This is negligible and can safely be ignored. In fact, it is much less than the probable error in the hob.

From the values derived in the complete paper the following tabulation is also made to show the various effects

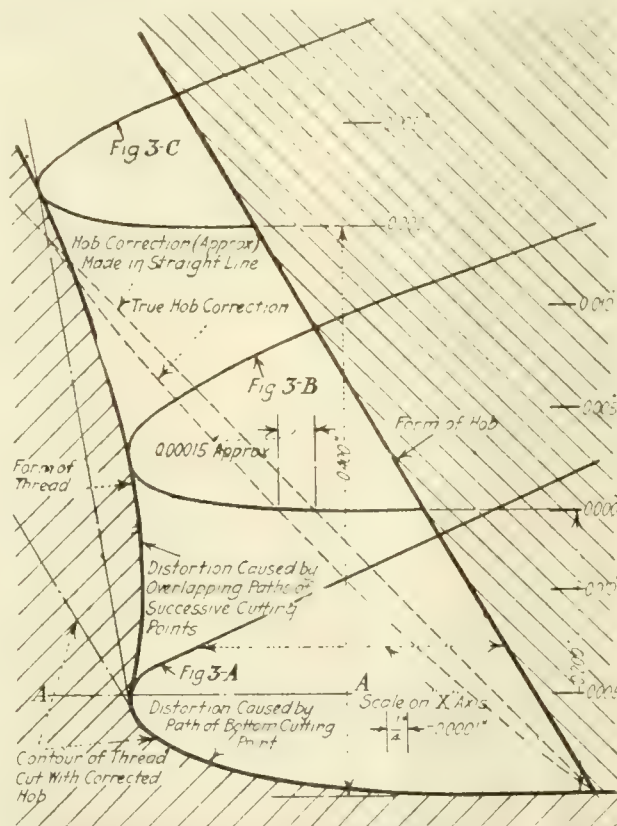


FIG. 1—CURVES SHOWING SHAPE OF CUTTING PATH.

of varying the diameter of the hob.
(See Fig. 5-B.):

Hob. diam. = 1.000 in.	2.0000 in.	4.000 in.
$x_s = 0.002695$	0.003475	0.004048
$y_s = 0.008912$	0.012344	0.014422
$2C' = 29^\circ 59' 26''$	$30^\circ 0' 16''$	$30^\circ 0' 54''$
$F - 2x_s = 0.0635$	0.0619	0.0608
$K = 0.000064$	0.000054	0.000026

From this tabulation it will be seen that the amount of side-cutting at the bottom of the thread (x_s) increases as the diameter of the hob is increased. The height of the fillet at the bottom of the thread (y_s) also increases as the diameter of the hob increases, in fact, it increases about three times as much in this case as x_s . The included angle of the corrected hob ($2C'$) increases very slightly as the diameter of the hob increases. The width of the point of the corrected hob ($F - 2x_s$) varies less than 0.003 in. as the diameter of the hob is increased from 1 in. to 4 in. The dimension K in Fig. 5-B is reduced as the diameter of the hob increases.

The correction for angle used in these solutions is a chordal correction. This shows a slight change in angle as the diameter of the hob varies. A geometrical solution of this side-cutting will show that, except for the fillet at the root of the thread, the profile is unchanged regardless of the diameter of the hob. Therefore, if the correction is taken as the tangent of the profile at the pitch line of the thread, the angle C' will remain unchanged. The formulae for determining this angle are as follows:

Let $C = \frac{1}{2}$ included angle of thread

$C' = \frac{1}{2}$ included angle of corrected

hob

H —helix angle of thread at pitch

line

Then

1

$\tan H$ —

$\pi N \times \text{pitch diam. of thread}$

and

$\tan^2 C' = \tan^2 C + \tan^2 H$

It is evident from the above that if the form of the cutting edge of a hob of a certain diameter be corrected to cut a thread of a certain diameter and pitch, a variation in the diameter of the hob of, say, 25 per cent. will have but little effect on the form of the thread produced on the work.

In order to determine the effect of varying the diameter of the work, the following tabulation was made for a hob 2.000 in. in diameter with 5 Acme threads per inch:

Work diam. = 1.000 in.	2.000 in.	4.000 in.
$x_s = 0.003475$	0.001161	0.000350
$y_s = 0.012344$	0.004103	0.001512
$2C' = 30^\circ 0' 16''$	$29^\circ 14' 8''$	$29^\circ 3' 6''$
$F - 2x_s = 0.0619$	0.0666	0.0682
$K = 0.000054$	0.000012	0.000003

The above tabulation shows that the amount of side-cutting at the bottom of the thread (x_s) decreases as the diameter of the work increases. The height

of the fillet at the bottom of the thread (y_s) decreases as the diameter of the

work increases. In this case it decreases about four times as much as x_s . The included angle of the corrected hob decreases quite rapidly as the diameter of the work increases. The width of the point of the corrected hob increases about 0.006 in. as the diameter of the work is increased from 1 in. to 4 in. The dimension K in Fig. 5-B decreases as the diameter of the work increases. In this case the amount of error introduced by a straight-line correction in the hob is in the fifth and sixth decimal place and is negligible. It is evident, therefore, that a hob which is corrected for a certain diameter of work cannot be used on work which varies very much in diameter if accurate results are desired. The smaller the diameter of the work, the more this condition is accentuated. This is due in large measure to the rapid increase of the helix angle on smaller diameters. On work of large diameters, where the helix angle employed is very small, little or no correction is required on the hob.

FIRMS THAT ARE ASKING FOR TRADE OPENINGS WITH CANADA

By communicating with this paper and mentioning key numbers, information can be obtained by firms interested in the following lines:

2684.—Wire from nickel chrome alloys.—A firm in Birmingham, England, desire to import from Canada special wire manufactured from nickel chrome alloys.

2686.—Radial Brick.—A firm in Boston, U.S.A., desires to be placed in communication with manufacturers of radial brick for use in building chimneys of power plants and similar structures.

2687.—An important French firm would like to trade with Canada, being specially well placed to export Mediterranean products, and in exchange would like to import wood pulp, acetic acid, mica and asbestos.

2689.—Vancouver concern having representation in Mexico, Japan, China, India, East Indies, Australia, and other countries bordering Pacific Ocean are anxious to get in touch with Canadian

2.000 in.	4.000 in.
0.001161	0.000350
0.004103	0.001512
$29^\circ 14' 8''$	$29^\circ 3' 6''$
0.0666	0.0682
0.000012	0.000003

manufacturers wishing to extend their operations in that field. Particularly interested in iron and steel, wire, wire nails, nuts and bolts.

BUSINESS IN OLD COUNTRY STEEL TRADE

Cutting Prices in Effort to Stimulate Business—Trade Is Not Brisk

In South Wales business continues quiet, but with the lower prices now prevailing it is anticipated that there will be a revival in the demand for steel, and this prospect is confirmed by the fact that a large furnace at Dowlais which has been out of blast for some time has been recently relighted. New furnaces have recently been brought into operation at Ebbw Vale and Blaenavon for the production of billets, etc., but in the latter case the steel departments are short of orders, and the depression in the tinplate trade is exercising a detrimental effect in the output of steel bars, prices of which have been twice reduced during the past few weeks. Until a month ago the official minimum was £21 10s.; this was later reduced to £18 10s., and followed by a further concession of £1 at the beginning of December. Even this price is being cut by non-associated makers, who are offering at £16. Welsh hematite is nominal at £13 to £13 10s., and steel rails have been done at £23.

Conditions at Sheffield

The steel-producing capacity of Sheffield has been greatly reduced on account of the depression, the open-hearth plant, vastly extended during the war, proving productive in excess of the present volume of demand. The trade in high-speed steel is also in a low state. As regards steel and manufactured goods, manufacturers have been disappointed by some heavy cancellations. The only departments which are fairly active are those producing railway steel, steel castings, tools for building and general trades, and agricultural tools.

Soon after the end of the boom prices of materials began to fall, and although the movement has been slow and has scarcely affected the best qualities of steel, it has made possible substantial reductions in the selling prices of finished goods produced from the cheaper steels. Iron has fairly held its own, but has now begun to fall. The output of wrought iron is so small, however, that makers can command their own terms.

The Imperial Oil Co., Ltd., are planning to erect a two-story, fireproof office, a large two-story fireproof garage, a boiler and pump house and a plant for the repair and care of barrels, at Brandon, Man. Two ten-thousand barrel tanks will also be installed and the necessary lubricating storage plants. It is expected construction will begin in the spring and be completed in the fall of 1921.

Effect of Relative Humidity on Leather Belts

Explanation of Humidity, Relative Humidity, Testing Apparatus, Atmospheric Control, Standard Conditions and Series of Tests

*By F. W. ROYS, M.E., Worcester Polytechnic Institute

ANY ONE who has ever had anything to do with leather belting knows that an ordinary oak tanned leather belt, not waterproofed or weather proofed, changes its characteristics considerably with the weather conditions, and it was because no information was available regarding these effects that the experiments were undertaken.

All of the experiments were made on a single specimen of belting, and it will not be contended that the results are applicable, directly, to any other belt. However, it is assumed that if consistent results have been obtained for this particular sample, other belts of the same sort of material will show similar characteristics, the same in kind, if not in amount.

Any work done in any branch of belt testing may easily run on interminably because there are so many variables that must be considered. It is therefore necessary to fix as many conditions as possible, and to accurately know all the others at any stage of the test.

In this particular investigation the following method was finally adopted:

1st. An oak tanned leather belt was selected. This belt was a 4" single belt about 25 feet long, first quality; 2nd. The belt was made endless and operated over a pair of 24-inch diameter, 6-inch crown face cast iron pulleys; 3rd. The belt speed was maintained as nearly constant as practicable at about 1,900 feet per minute; 4th. The transmitted horse power was kept constant; 5th. The temperature was kept constant except in the last part of the work when the sum of the belt tensions was kept constant instead.

*A paper read before the National Association of Leather Belting Manufacturers.

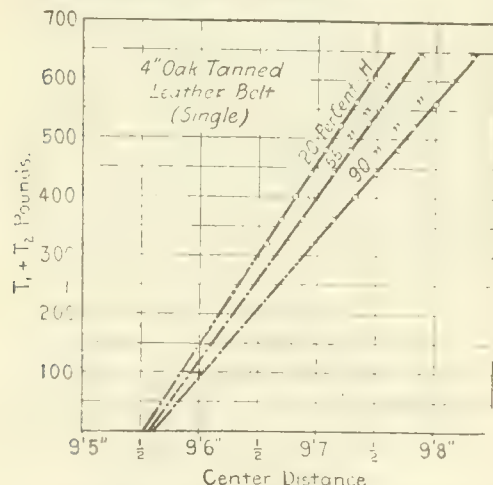


FIG. 2--RELATION BETWEEN $T_1 + T_2$ AND CENTER DISTANCE AT THREE CONDITIONS OF RELATIVE HUMIDITY. HORSE POWER CONSTANT.

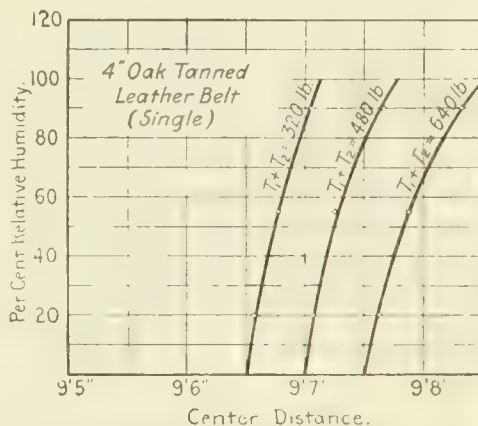


FIG. 3 RELATION BETWEEN PER CENT. RELATIVE HUMIDITY AND CENTER DISTANCE AT THREE CONDITIONS OF $T_1 + T_2$. HORSE POWER CONSTANT.

Having fixed the above conditions it was considered that three important ones were left to vary. They are: 1st, the belt length; 2nd, the sum of the tensions in the tight and slack sides of the belt; 3rd, the relative humidity.

Explanation of Humidity

The condition of the atmosphere which has to do with the moisture content is called humidity. The actual weight of water vapor held in a cubic unit of the atmosphere is understood as the absolute humidity, and this amount of moisture varies greatly with the temperature.

The ratio between the amount of water vapor actually in the atmosphere at

any temperature compared to the maximum amount which it would carry at that temperature is known as the relative humidity. Either one of these ways of considering the humidity might have been used, but it seemed more natural to use relative humidity for this work and it is felt that it will be of more benefit to most people to consider the effects from that standpoint.

Measurement of the Different Variables

Belt Length. Instead of measuring the belt length directly the distance between the shaft centers was measured as being a direct function of the belt length.

Some of the tensions. $T_1 + T_2$. When a belt is working over any pulley, the tension of one side is of course greater than on the other side of the pulley. The tension in the tight side is to be designated as T_1 , and the tension in the slack side as T_2 . Then $T_1 + T_2$ is the total pull of the belt from both sides of the pulley (see blackboard sketch). The sum of the tensions was easily measured by means of platform scales bearing the foot of a bell-crank lever whose arm was connected by a chain to the carriage of the apparatus. See Fig. 1.

Relative Humidity. The relative humidity was determined by a sling psychrometer, similar to the type developed by the U. S. Weather Bureau. The sling psychrometer is a simple instrument made of two mercurial thermometers placed side by side in a frame. The

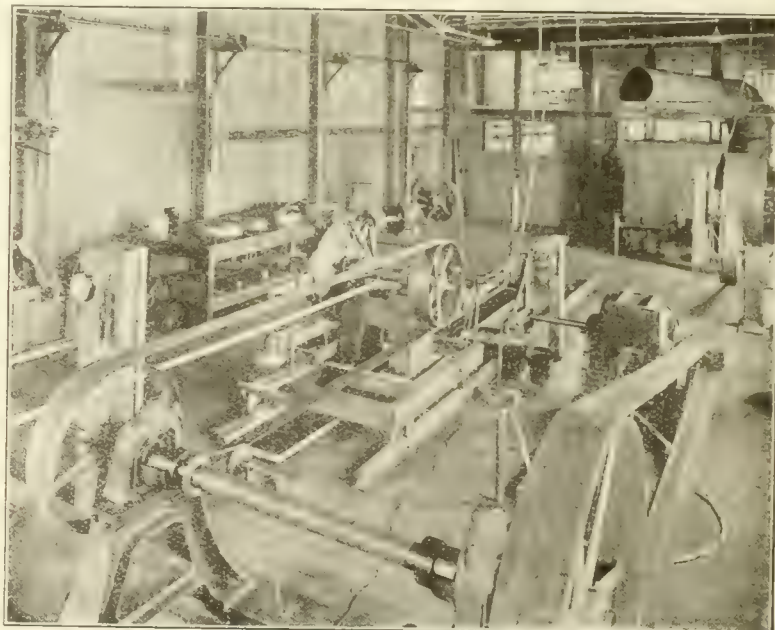


FIG. 1--SHOWING THE APPARATUS USED.

same is attached at one end to the swivel handle so that it may be whirled, thereby causing the thermometer bulbs to move rapidly through the air. One of the bulbs is covered with a piece of fine muslin and, before the instrument is whirled, this muslin is dipped in water. It thus is a special type of wet and dry bulb thermometer set. The advantage of the type of wet and dry bulb thermometer is that the rate of evaporation is much more definitely controlled than in an ordinary stationary set which has to depend on whatever air currents may be stirring.

A precision hair hygrometer was also used, but could not be depended upon except to indicate whether the humidity was constant or not.

Method Used in Investigation

In order to study the three variables already referred to above three sets of experiments were carried out as follows: First. Determination of the relation between the center distance and $T_1 + T_2$, relative humidity remaining constant. This simply means that the tightness, or looseness as you please, was varied and the corresponding stretch carefully noted, great care being taken to see that the atmospheric conditions did not change.

Second. Determination of the relation between center distance and relative humidity. $T_1 + T_2$ remaining constant. Or in other words, the condition of the atmosphere was changed and the corresponding stretch or contraction was noted, care being taken that the sum of the tensions, or $T_1 + T_2$, did not vary.

Third. Determination of the relation between relative humidity and the sum of the tensions. Center distance remaining constant. This means that the condition of the atmosphere was varied and the effect on the sum of the tensions as noted, while care was taken to see that the center distance remained always the same.

Description of the Apparatus

A general layout of the apparatus used in these experiments, which were conducted at the Worcester Polytechnic Institute, is shown in Fig. 1.

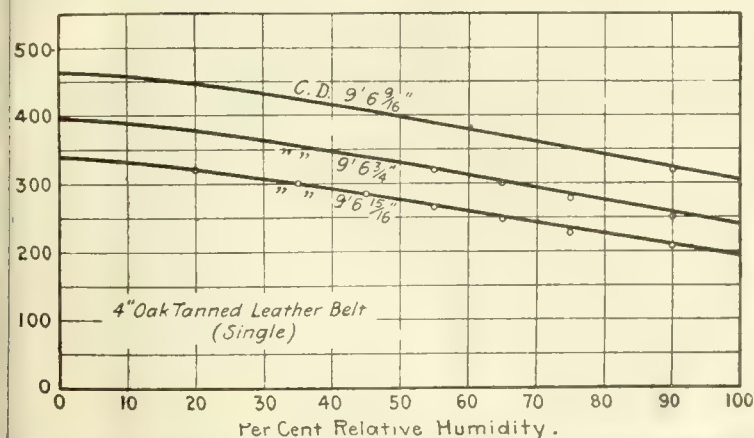


FIG. 5—RELATION BETWEEN $T_1 + T_2$ AND PER CENT. RELATIVE HUMIDITY FOR THREE CONDITIONS OF CENTER DISTANCE HORSE POWER CONSTANT.

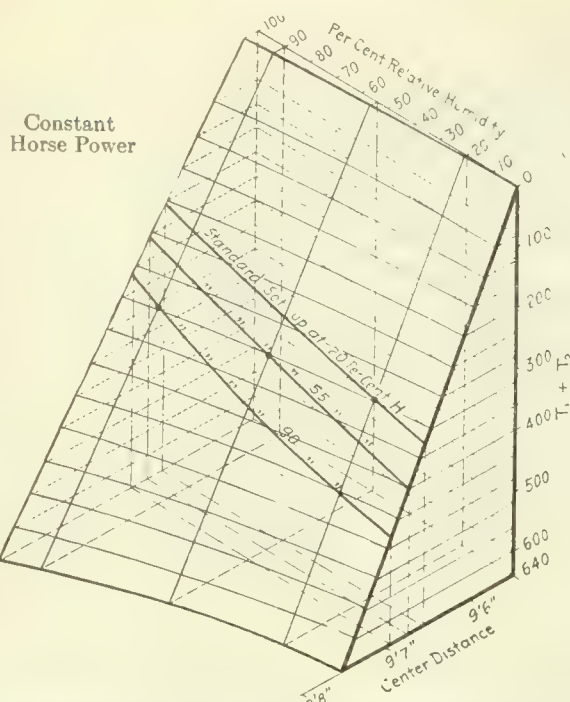


FIG. 4 BELT PERFORMANCE SURFACE FOR AN OAK TANNED LEATHER BELT 4 IN. WIDE, SHOWING RELATION BETWEEN CENTER DISTANCE, SUM OF TENSIONS AND PER CENT. RELATIVE HUMIDITY.

It consists of a driving pulley mounted on a shaft whose bearings are in fixed hangers and a driven pulley mounted on a shaft carried by a base which rests on a movable carriage. If power is to be delivered to the pulley on the movable base two reactions must be furnished. First there must be a direct pull to equal the sum of the belt tensions. This pull is furnished through a chain, equipped with turnbuckles for adjustment, one end of which is fastened to the carriage and the other to the bell-crank lever which has already been mentioned and which serves to measure the amount of the reaction. Second there is the torque or twist. This torque is furnished by an Alden absorption dynamometer, and the amount of the torque is weighed by balancing the dynamometer

with standard weights at the end of a definite length of lever arm.

The Alden dynamometer is simply a defined form of Prony brake of large capacity in proportion to its size. A single disc dynamometer consists of a cast iron disc which is keyed to the shaft, and which rotates in oil between two copper plates which are fastened to the casing. Water under pressure is admitted to the casing, thereby pressing the coppers toward the cast iron disc and making the oil film thinner. The more viscous the oil and the thinner the oil film the greater the torque required. The casing, not being keyed to the shaft, is restrained from turning and the force, at a definite radius, necessary to restrain it is a factor in determining the power transmitted. The water

not only furnishes pressure, but since there is a constant circulation it also serves to take away the heat of friction. An automatic valve serves to regulate the pressure and the regulation is so nice that oftentimes one of these brakes will run for an hour or more if necessary, always in perfect balance.

The load on the dynamometer is a direct function of the difference in tensions or $T_1 + T_2$. Since $T_1 + T_2$ and $T_1 - T_2$ are both easily measured T_1 and T_2 may each be easily calculated.

Atmospheric Control

A Sturtevant heater and blower was used to heat and circulate the air. At first it was attempted to control the humidity by a humidifier such as is used in cotton mills, but finally a live steam

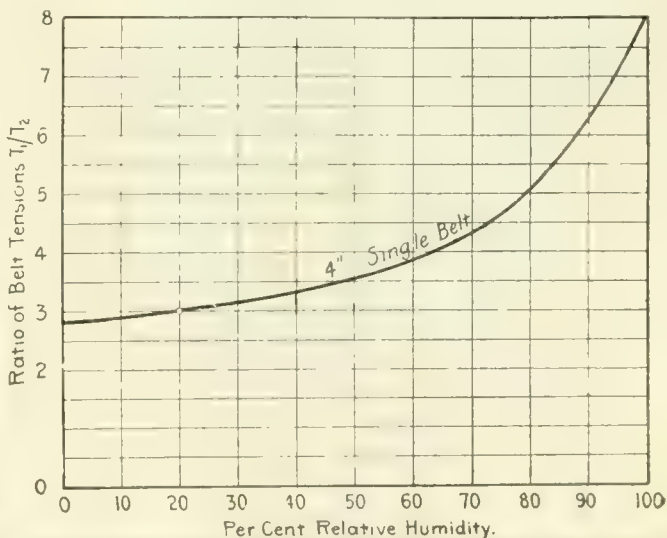


FIG. 6 EFFECT OF CHANGE OF HUMIDITY FROM 20 PER CENT. HORSE POWER CONSTANT.

jet was used altogether. It was found that the humidifier made just a fog, that is minute globules of water suspended in the air, and not vapor containing the heat of vaporization. It was found that no consistent results could be obtained when using the humidifier, but that perfect consistent results which could be duplicated at any time were obtained by the second method.

Standard Conditions

Certain ideal conditions were assumed as a standard. These were as follows:— Tension in the tight side of the belt $T_1 = 240$ lbs. or 60 lbs. per inch of width. Ratio of the tension in the tight side to the tension in the slack side 3 to 1.

Now if $T_1 = 240$ and $T_1/T_2 = 3$ and we wish to know the tension T_2 we have

$$\frac{240}{T_2} = 3$$

Or $3T_2 = 240$

and $T_2 = 80$

Then $T_1 - T_2 = 240 - 80 = 160$ lbs.

This difference in the belt tensions multiplied by the radius of the pulley, in fact, is the number of foot-pounds of torque received by the belt. The power transmitted is of course also a function of the speed and in this case the speed was such that the horse power was approximately 9.21. This value for the horse power prevailed throughout the test and since the speed was constant the value of $T_1 - T_2$ remained constant regardless of what either T_1 or T_2 may have been.

For the specimen belt which was used and for the conditions stated above, the creep was between 0.8 and 0.9%.

First Series of Tests

The first series of tests was made by changing the sum of the tensions and measuring the centre distance (belt length) for three different values of relative humidity. The three values of the relative humidity were 20%, 55%, and 90%.

Fig. 2 shows the results of this test graphically and the significance of it is that the modulus of elasticity of the belt, or the ratio between the load applied and the stretch produced, is different for different values of the relative humidity. It is readily seen from the diagram that

given change in tension at a high humidity than at a low.

Second Series of Tests

The second series of tests, that is the series with $T_1 + T_2$ constant, was carried out with three different values of $T_1 + T_2$. Fig. 3 shows these results graphically and it shows quite clearly that the stretch of a belt for a given change in

good evidence that there was no error of any account in the other work.

Conclusions

The warped surface shown in Fig. 4 might well be called the characteristic of this belt and it indicates in a general way what might be expected from similar belts. Leather itself will vary due to various causes as you are well aware.

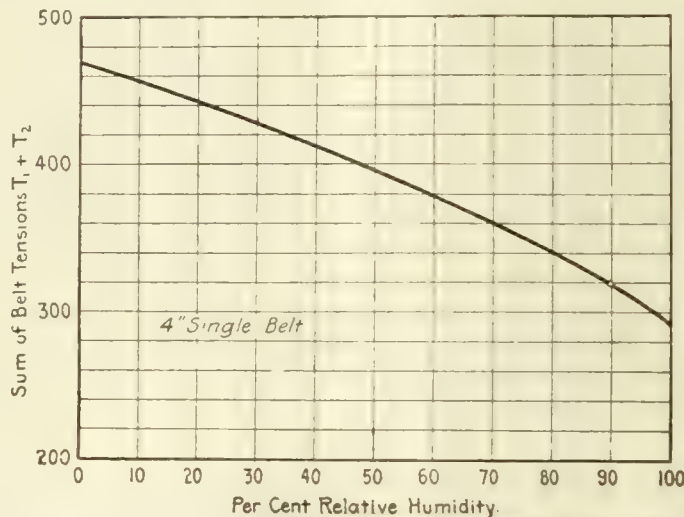


FIG. 7—EFFECT OF CHANGE OF HUMIDITY FROM 90 PER CENT. HORSE POWER CONSTANT.

humidity is greater at high tensions than at low. It would be strange if this were not the case but this test showed just what the variation was.

From these two sets of data which are in terms of three variables it is possible to construct a diagram in space and the result is a surface such as is shown by the diagonal face of Fig. 4. Any one of the curves already referred to may be located on this surface. It is only necessary to know what condition was constant and also the value of that constant and then to trace the curve in terms of the other two coordinates.

The data for the construction of Fig. 5 was obtained in this manner and the curves were drawn. Afterward the belt was operated at different values of relative humidity and the value of T_1/T_2 was noted. The plotted points are the results of the experiments and the fact that they lie so close to the calculated position is All of the factors being more or less un-

known it is impossible to make definite predictions regarding other leather belts.

However in a general way it may be stated that the effect of a change in the relative humidity is greater at high humidities than at low; that the effect is shown more rapidly in single than in double belts; that increasing the humidity shows practically immediate results, while a decrease in the humidity takes a longer time to be effective.

Much more attention should be paid to the effect of the relative humidity than is ordinarily the case. This will be apparent from the discussion that follows.

Suppose that a plant has an engineer who is supposed to see to it that belts are kept tight and working at the proper tensions. Suppose also that he pays no attention to the weather conditions, but has the belt tightened to a tension which he calls standard.

Continued on page 99

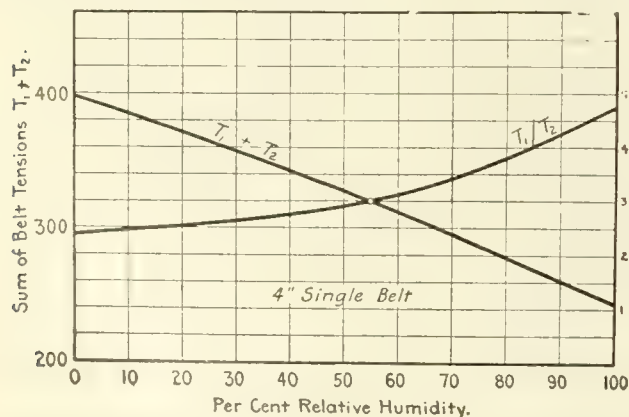


FIG. 8—EFFECT OF CHANGE OF HUMIDITY FROM 55 PER CENT. HORSE POWER CONSTANT.

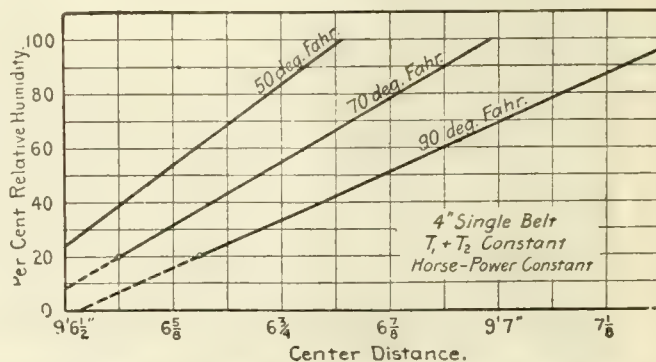
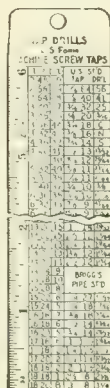


FIG. 9—RELATION BETWEEN CENTER DISTANCE AND RELATIVE HUMIDITY THREE DIFFERENT TEMPERATURES.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.

To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Here are the two prize-winners for the January 13th contest. Daniel Sheg, 559B Berri St., Montreal, and George Land, 567 Patterson St., Peterboro', Ont. One of our contestants asked this question, "Can any reader of Canadian Machinery try this contest, even though he is not a subscriber." Certainly, the more answers we receive, the better we are pleased, although we cannot imagine anyone reading Canadian Machinery and still remaining a non-subscriber.—Editor.

CONTEST FOR FEBRUARY 3RD ISSUE

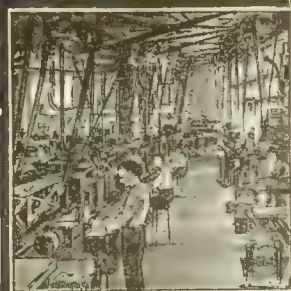
Contestants are required to write us, stating to which advertisements we refer in this number.

- 1—Something that lifts 200 times its own weight.
- 2—Something that is like a cannibal—eats them up.
- 3—A product said to be of dependable character.
- 4—What to do if you have work requiring accuracy.
- 5—How to increase production.
- 6—How to become a candidate for a steady job holding a tin cup.
- 7—Something said to be equally efficient for light or heavy work.
- 8—How to save many valuable hours.
- 9—Something that will stand up to its work.
- 10—Something that has served five years' service and is still a favorite.
- 11—How to make sure of good gears.
- 12—How to save money on cost, also delay in deliveries.

These are Correct Answers for List from January 13th Issue:

- 1—Dominion Oxygen Co., Ltd.
- 2—Bristol Co.
- 3—H. H. Robertson Co.
- 4—J. H. Williams & Co.
- 5—Wright Mfg. Co.
- 6—Holden Co.
- 7—Nicholson File Co.
- 8—Victor Tool Co.
- 9—Landis Tool Co.
- 10—Wilt Twist Drill Co.
- 11—J. T. Hepburn.
- 12—In the Classified Section, or Buyers' Directory of Canadian Machinery.

Closing Date for This Contest is February 24th



DEVELOPMENTS IN SHOP EQUIPMENT



MACHINE WITH MANY USES

You can accomplish surfacing, boring, milling, drilling and tapping on the one machine. Briefly, that is what H. W. Kearns & Co. Ltd., Broadheath, England, claim for their patented multi-purpose machine shown in Figs. 1 to 3 inclusive. These machines are made in two types, known as the standard and the patent machine. In all essential features they are similar, and with the exception of certain parts are identical and interchangeable. The standard machines are fully universal, and are capable of handling a very large variety of work.

They are said to be especially suited for marine work, pump work, and in fact any work of large size, and where the operations take considerable time, also where the diameters dealt with are well up to the capacity of the machine. All boring feeds are obtained by travelling

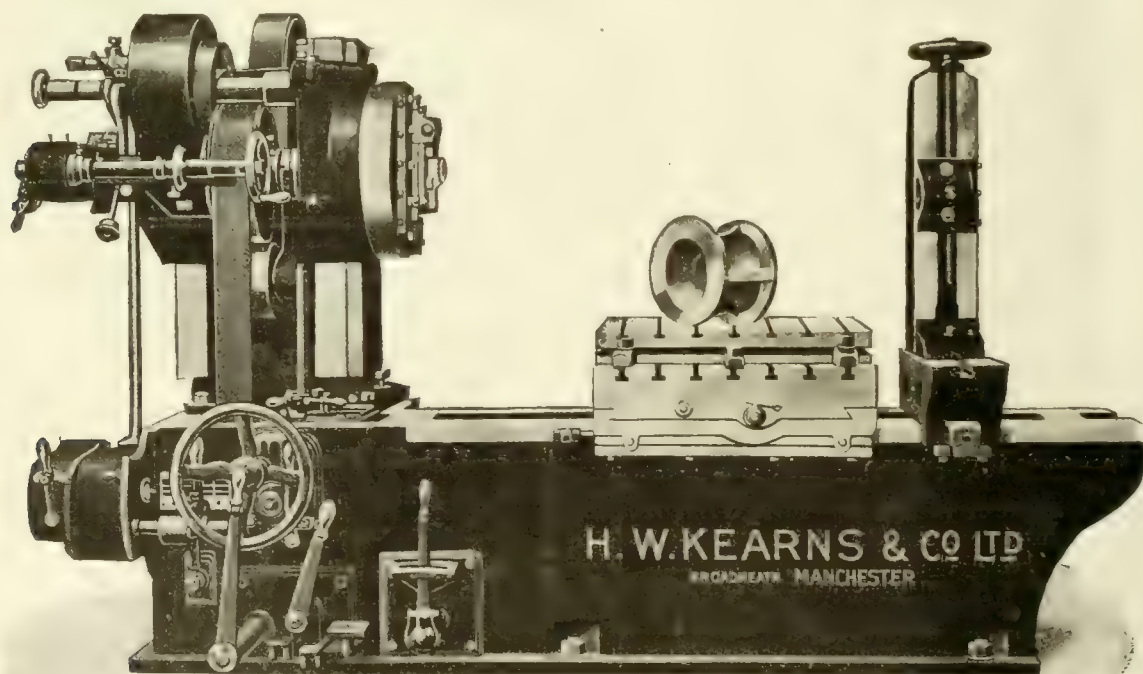
This concern have proved by experience that a demand exists for a machine similar to the above, but with the addition of a travelling spindle, so the patent machine, next to be described, was produced. This latter machine contains all the features of the former with the addition of a travelling spindle of substantial diameter. The advantages of such an addition for certain classes of work are easily understood. Where the operations are great in number, and the holes to be bored are of small or medium diameter, it is much more convenient to travel the spindle. The patent machines are supplied with a larger table than the standard type. This is due to the fact that there is a tendency to require less space between the boring bar socket and stay on this type of machine, owing to the reduced need to travel the tables where a travelling spindle is available.

the independent action of the spindle will be found of benefit for drilling, tapping, and boring of small diameters. In addition to these features the momentum of the facing chuck when running at high speeds is avoided. Where cylindrical articles are manufactured in large quantities, the patent machine will bore and face simultaneously.

At Fig. 1 is shown a general view of what is known as the No. II standard machine, while at Fig. 2 is illustrated the facing slide for the standard type of machine. Fig. 3 depicts the type of facing slide for the patent machine, and it will be noted in this latter case that a clear hole is left through the spindle of the clutch to carry the travelling spindle.

Facing Slides

The facing slides on these machines are patented and embody certain fea-



GENERAL APPEARANCE OF THE NO. II. STANDARD MACHINE.

the tables, and this is the method they recommend for holes of large diameter, as it allows them to use good substantial bars.

The travelling spindle can be revolved either simultaneously with, or independently of, the facing chuck. This is a feature of considerable importance, as

tures. For example, they are capable of facing from the maximum diameter to zero without adjustment. This overcomes the usual trouble of changing the

position of nut before the job can be completed. Before adopting the present patented facing head they had this trouble to contend with, and the adoption of this type of head has saved considerable time. Their patent clutch consists of a section of a worm, operated on a helical rack carried on the back of the facing slide. Ball thrusts are provided in each direction, and in addition to the advantage already mentioned, increased bearing surface and reduction of effort required for hand adjustment are obtained. The facing tool is arranged to make an acute angle with the work, thus reducing the chance of chatter. This principle is found of special value when finishing work at a broad rate of travel. The slide is fitted with detachable socket for carrying boring bars, twist drills, reamers, snout boring tools and milling cutters. Special adjusting strips are provided which ensure the slide remaining in truth when in central position.

In the patent machine head (see Fig. 3) it will be noticed that a radial motion is given to the facing clutch by means of a scroll plate carried at the back of the facing slide. The engaging portion of this plate is of large diameter, and it makes engagement with two scroll sections spaced sufficiently widely apart to admit between them the travelling spindle. Automatic feed is obtained in either direction by accelerating or retarding the scroll plate relative to the facing slide. This feed is obtained from the main feed box operating through an epicycle gear. By this means a wide range of feeds is obtained. The facing head is provided with tee slots running its full length. The tool holder can thus

be placed in the most convenient position, and a boring bar is supplied which is secured to the facing slide for use when it is desirable to use fixed bars of large diameters in conjunction with the table feed.

Spindle Slides

The vertical sliding head is geared to enable the machine to deal with work varying from the largest to the smallest diameter, and power is transmitted to the spindle by means of an endless belt. When drilling or boring small diameters this driving pulley is directly connected to the spindle, thus obtaining direct drive without the intervention of toothed gearing. In holes of large diameter the power is transmitted from the belt to the spindle through gearing of ample purchase, operating on an external pinion, driving through spur ring of large diameter. The spindle is relieved of all torsional stress when boring large diameters. All bearings are of ample proportion, and are kept as far apart as possible, thus allowing the use of snout boring tools.

The spindle slide on the patent machine is identical with the one already explained, and the travelling spindle is carried on bearings of ample length. Automatic feed to the spindle is provided in either direction, together with reverse motion for tapping. The spindle is gripped in a tail bracket, and is sufficiently long to give twice the travel provided with instantaneous engagement for automatic feed. A fine hand adjustment is also provided.

The feed motion to facing slide is of patented improved design, and these

feeds are now taken from the main feed box. This is connected to the facing slide through epicycle gearing, with the result that as many feeds are provided to the facing slide in either direction as are provided to the other motions of the machine. In other words eight feeds in either direction are provided to the facing slides on the standard machines.

The Tables

The machine is provided with a rectangular main table arranged with adequate cross traverse. On the main table is fitted a detachable square turntable which enables the machine to operate on all four sides of the work at one setting. The table can be locked in any position, and at any angle. It is fitted with a special patented locating arrangement which locks it securely at each 90 degrees.

Tee slots are provided on both tables. A centering pin is used whereby the detachable turntable is located central with the spindle. A spacing arrangement is also provided when required that enables the proceeding of repeat articles with perfect uniformity.

Rapid Power Traverse

The machine is fully automatic, variable and reversible feeds being provided to the longitudinal and transverse motions of the table, and to the vertical motion of the sliding head. This renders the machine capable of milling in all directions. Rapid power traverse is provided to the whole of these motions in either direction. This traverse is independent of the feeds, and is of constant speed.

Alfred Herbert, Ltd., are handling these machines for the Canadian trade, from their offices at 1-3 Jarvis St., Toronto.

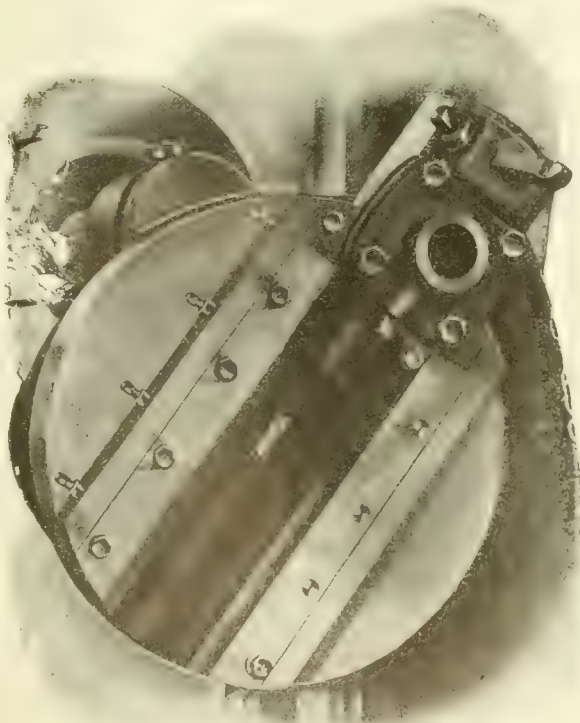


FIG. 2—VIEW OF FACING SLIDE AS USED ON STANDARD MACHINE.

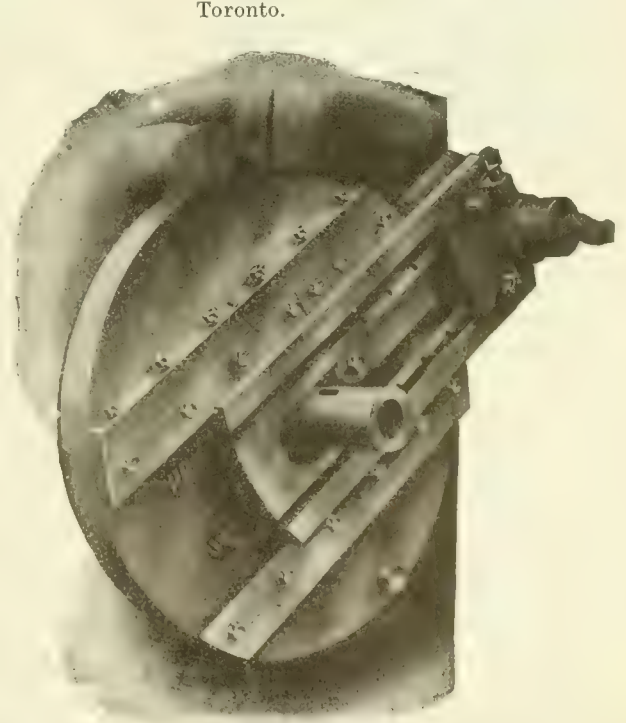


FIG. 3—THIS TYPE OF FACING SLIDE IS USED ON PATENT MACHINE.

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Asking—And Getting It

AT a meeting of the Canadian Association of British Manufacturers held in Toronto a few days ago, several remarks were made by representatives from various fields and the trend of these could be interpreted as meaning that conditions were mending. One dealer put the thing tersely when he said: "We are asking for business now and we are getting it."

The casualty list in Canadian industry has been light and the same holds good in other fields.

Dealers in other lines, such as foodstuffs, are protecting their customers for a reasonable length of time on prices. That is, they promise stability of prices for a period that will allow the dealer to dispose of a reasonable amount of goods. It is encouraging buying on a larger scale and the movement is growing.

The Market Not Crowded

IN a signed statement by T. A. Russell, president of the Willys-Overland Co., the much-repeated talk of overstocked automobile dealers is plainly denied. The remark has often been made that as soon as prices were cut some months ago dealers rushed in and bought very large stocks for the 1921 trade and therefore put an end to the buying movement as far as they were concerned for some time to come. Mr. Russell's statement follows:

"Motor dealers in Canada can look forward to 1921 with confidence. The statistics which were prepared by the manufacturers and dealers for submission to the Government in connection with the question of luxury taxes, brought out the surprising fact that the total number of

cars in the hands of dealers, throughout the whole of Canada, did not exceed the normal production of the Canadian factories for one month. In other words, one month of normal sales would dispose of a greater number of cars than were in stock in the hands of dealers in Canada on January 1, 1921."

Dealing with general conditions, all of which will have a very direct bearing on the sale of cars and other business, Mr. Russell goes on to say: "A large part of Canada's grain crop has not been moved. Canadian banks and institutions have stood the strain of reconstruction without an important casualty. Liquidation, which has been so general, has been accomplished without shaking our commercial credit. Are these conditions not a sound basis for a healthy and profitable business in 1921?"

Making Salesmen Now

THERE are certain business houses where the visitor knows what to expect now. Go in and make a call. Sit down and talk for a few minutes. You will come out with an ear full of gloom. You will hear that the firm is not making money; that they are not selling as much as they did last year; that the future is uncertain.

After one gets well sprayed with that kind of speech it is easy to pass a little of it along.

Thank goodness there are other places. This week we found one that was out for a record year. Yes—not an inch less—out for a record year.

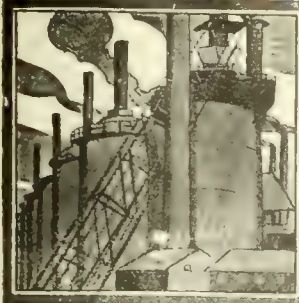
Their motto may be rather straight and unadorned, but it means this—the way to get business is to get it.

"We are going after business now in a way that some of our new salesmen never heard of before. There has not been much selling done since 1915—largely a case of taking orders. It's bad for the whole force. Salesmen are developed when business is not brisk, when the traveler has to think, has to study the business of his client, has to find out if he has anything to sell him that he should have. We believe there will be more salesmen developed in Canada during the year 1921 than there have in the previous five years."



THE FORD LEADS THE WAY

Fine! But it isn't every vehicle that can make as short a turn as a Henry!
—Spencer in Omaha "World-Herald."



MARKET DEVELOPMENTS



Inquiries Are Numerous, But Not The Orders

Pittsburgh Despatch Intimates That New Basis For Steel Values May Be Reached—A Few Reductions Made in the Price of Tools—Scrap Metal Prices are Marked Down in This District To Very Low Levels.

PRICE talk is heard again in the markets this week, but this does not mean that there is going to be any immediate advantage in it for the Canadian buyer. New York reports that two makers have brought out new selling schedules, but there is nothing to show that the action has aided in the closing of any more business. Pittsburgh also talks about a new basis for steel prices, but intimates that the time is not ripe yet for the bringing of these into effect. Wages and other costs will have to be dealt with first, and there is a feeling that cuts in wages would lead the buying public to turn on the steel makers and ask them for cheaper steel.

Machine tool dealers in Canada are working harder for business than for some time past and the experience of

many is that the firms that are working hardest to secure business are meeting with the most gratifying results. The change in the attitude of some American firms in opening a Canadian account and taking payment in Canadian funds has also helped sales.

Buying that is being done, though, is on a small scale, although reports indicate that industry in Canada is improving. Some shops are releasing orders they have held up for some months and more are getting under way even if on a small scale.

The scrap metal market was further marked down this week, many of the figures now named being only shadows of their former war-time greatness. Even at this schedule there is little trading being done.

SOME LARGE SHOPS IN MONTREAL ARE FARMING THEIR WORK OUT

Special to CANADIAN MACHINERY.

MONTREAL, Feb. 3.—The past week has brought nothing new to the surface. Some reports indicate that business is more brisk, while on the other hand one hears of the suspension of operations at some of the larger plants, with many willing, but not knowing how, to help put trading on a firmer basis. When speaking to the proprietor of a small machine shop here he made the remark that: "We have succeeded in obtaining sufficient work to keep us going for several months, and with the promise of more. The peculiar fact, however, is that this work has been obtained from one of the largest firms in the city, as it appears that they have let nearly all of the tool makers go, and when it is necessary to have such work done they are sending it out to the small shops. It is my belief that the small shops will be the first to benefit from the situation now confronting us, as the larger shops will prefer to have work sent out rather than take on more men just now, or until there is a general return to normal activity."

Steel Remains Quiet

"We are still looking forward to the time when business will be more than the answering of inquiries. If orders resulted from all of these we would have no cause for worry, but in the great ma-

jority of cases it seems as though they were feelers to get the trend of the market." This statement by a steel dealer would indicate that buying is contemplated, but that their needs are not sufficiently urgent to place an order, except it be for material wanted for immediate use. There is a tendency on the part of sales organizations to offer inducements to buyers to fill their requirements, but these are not shown on the price quotations, the latter being maintained for moral influence. The feature that dominates present trading is the lack of interest shown by the average consumer, and this attitude makes it all the harder for the salesman when trying to secure an order. "We cannot complain of present business," said one dealer, "as we do not expect any heavy buying at this season of the year. We are keeping just sufficient stock to satisfy the spasmodic demand of the trade. January and February are usually quiet in normal times, so we are showing no anxiety. Should our expectations be realized we will in a few months require to carry more in our warehouse to meet the summer needs of the trade." Local quotations are firmly held in many cases. Sheets are easing off somewhat, and that in face of the gradual return of automobile activity.

No visible improvement has, as yet,

developed in machine tool movement, although a few dealers state that the past week has brought out several interesting inquiries. Not all of these have resulted in sales but the encouraging tone has given heart to those who have frequently despaired of an early return to active business. "We cannot say that present business is much improved over that of the past few weeks," remarked a dealer here, "but when you realize that the past three or four months have produced little more than sufficient to pay overhead, the possibility of increased business is an encouraging feature in an otherwise quiet period. We are not anticipating any rapid return of normal activity but everything points to a steady betterment in business generally, a condition that will naturally be shared by those in the machine tool lines. Prices—this is a question not easily settled. Of course, some makers endeavor to meet the desires of the trade in this respect, but new tools continue to find their way to the users at figures in keeping with general conditions, and these require that a fairly high standard be maintained."

Those houses that make a practice of catering to the rural districts have been fortunate in securing some business but usually small and well distributed orders. Even this, however, is very acceptable. There is still a fair movement in small supplies but volume is light, salesmen endeavoring to maintain sales by extending their calls and covering more territory.

CANADIAN FUNDS MADE THE SALE

Feeling Grows That Firms That Get
Out After Business Will Secure
Orders

TORONTO.—One has not to make many calls in the Toronto market at present to pick up any shade or variety of opinion, but through them all there is a note that the worst has happened, and events are certain to turn for the better soon. Even in cases where they admit that it is a case of nearly all going out with very little coming in, they look forward to a good year's business, and look upon the present in the light of the whole year.

"We are going to have a good year," was the statement of one firm this morning. "We are going to have a good year because we are going after the business in a different way. Our men are out now to sell, and not simply to take orders. It's not a good thing to have business coming too easy. It is a great chance right now for salesmen to show that they know something about the fine points of the game. It has been no trick for some years past to make a showing like a fairly good machine tool salesman, but for the past six months or so this has changed. The man who can get away now and pick business out of this market is the man we want around here. It's a great chance for men out selling to do some real constructive work now. We are finding out that the man who gets out now and fights for business is getting the results."

Machine tool dealers report nothing from their principals that would indicate any intention on their part to let down the prices. In fact the matter is not discussed in the markets now nearly as much as it was a few weeks ago. It seems to be generally conceded that there will be price changes some time later on, but it cannot be said that this consideration is making much difference. There are other factors, amounting to about the same thing, though, that do result in sales, and it is worth noting that other cases might work out the same way.

Here is the Case

A Canadian firm had secured a figure from a Toronto house on a certain kind of drill for a special purpose. The first quotation was made last May, but the deal was not closed, and apparently the would-be purchaser had let the matter drop. He called up on the phone the first of this week, and asked what the price was at the present time. He was informed that there had been no change in the price, but that the firm would now accept Canadian funds at par, a change which had been made in their selling policy since the quotation in

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh states that the price of steel may come to a lower level, but the present is not an opportune time to bring about this change. Wages and other costs will have to come down first.

Steel Corporation mills are continuing to operate within 10 to 12 per cent. of their capacity on orders booked some time ago. There is not much new business being placed.

Some of the larger shops are farming out portions of their work rather than start their whole plant operating.

The prices that dealers were paying for scrap metal were cut again this week. Any sales that are taking place now will bear an intrinsic value to the market.

The steel companies have enough scrap to last them for months to come, and foundries are buying only what they need.

One maker of grinding machines and another manufacturer of shapers have announced reductions in their selling prices, but other machine tool makers have not followed suit.

May. "If that's the case, send along the machine," was the answer.

Steel Market Quiet

Steel prices have not changed during the week, nor are there indications that there will be anything much of a departure from present lists for some time. There are offers made to Canadian dealers now to take on tonnages from American rolling mills that are out looking for business, but the average yard in Canada has all the material it cares to handle now, and for the most part they much prefer to clean out their stock, even without profit, rather than add to it at fairly close prices.

There is a certain amount of buying being done, but it is not in a large way.

More Prices Are Cut

The prices which dealers will pay for scrap material were operated on again this week, and now they possess only a very small share of their former wartime greatness. In fact were the dealer to take his club and whack the schedule any lower it would simply cease to exist.

Speaking of the changes, one of the dealers said "Foundries are not taking on anything to speak of, neither are the steel companies. The latter are pretty

well loaded. If some of them keep on producing at their present low rates they will not have to buy anything for the next year or so. The large dealers are not taking on anything. They are pretty well stocked, and are afraid of even lower prices. They have been taking their losses pretty regularly for some time now. Anything that is bought or sold at present prices is below the intrinsic value of the material, but that seems to make no difference."

One might imagine it would be a good time for the speculators to get busy in the metal market, but they are afraid of it. When copper came down recently and hit 14 cents for the first time in many months, there were several in this district quite eager to go in and take a chance. They did, and all that is necessary is to say that to-day copper can be bought in New York at between 12 and 13 cents.

NEW YORK MARKET STILL MINUS ORDERS

Some Changes Have Been Made in Selling Prices, but They Are Not General

Special to CANADIAN MACHINERY.

NEW YORK, Feb. 3.—There is as yet no marked improvement in the demand for machine tools, though a fair number of inquiries for single machines is being received. Orders are few, however, and buyers are evidently awaiting the working out of the price situation.

The most important reduction of the past week was that of the Norton Company, Worcester, Mass., which made varying changes in its prices on grinding machines and grinding wheels. These declines approximated 15 per cent. Other wheel manufacturers have also reduced, but the reduction in grinding machines is not general. Some of the Norton Company's competitors on tools have not indicated whether they will or will not make like reductions.

Manufacturers of shapers have likewise not followed the action of Gould & Eberhardt in reducing prices about 15 per cent.

Prices on riveting machines made in New England have been reduced 12½ per cent. Nearly all of the makers of precision bench lathes have reduced prices.

A large manufacturer of foundry equipment announces a second reduction of prices within one month, making a 20 per cent. cut in all.

Some of the machine tool manufacturers intimate that they will make no reductions at present. The general disposition toward the price question is that reductions at this time will not stimulate buying.

During the past week or two there has been a slight improvement in business among some of the metal-working industries. The improvement is in evidence mostly in the smaller shops.

Many of the large plants are wholly or partially shut down. The General Electric Company has just announced a reduction in wages and has also cut down the size of its office forces. This is typical of the situation as it exists among many metal-working plants.

It is the general opinion that a slow but gradual improvement in the business situation may be expected from now on. Few, however, are willing to predict that there will be any real activity in some of the metal-working lines before the last half of the year.

STEEL PRICES MAY SHIFT AGAIN BUT TIME FOR IT IS NOT RIPE

Special to CANADIAN MACHINERY.

PITTSBURGH, February 3. — There has been a slight increase in production by independent steel mills as a whole, the average rate of output by independents now being in the neighborhood of 30 per cent., against a 25 per cent. average for several weeks. The increase in production, however, does not seem to reflect any definite increase in demand, but seems due rather to several mills chancing to resume work at the same time, after a spell of idleness in which they allowed orders and "releases" to accumulate, the releases being withdrawals of instructions previously issued to discontinue shipments on old orders. At some time in the future several mills may chance to go down entirely at the same time, and then a particularly low operating rate will be shown.

The Steel Corporation is operating at an average of about 90 per cent., on the basis of the steel ingot production. Operations have decreased slightly of late by the American Steel & Wire Company, Illinois Steel Company (operating also the Gary plant) and the Tennessee Coal, Iron & Railroad Company. The National Tube Company continues to operate full. The Carnegie Steel Company has been maintaining an average output of ingots 96 per cent. of rated capacity, and last week blew in an additional blast furnace, making 48 Carnegie stacks in operation, the largest number for months. The American Sheet & Tin Plate Company, an important subsidiary of the Steel Corporation, but one that makes very little steel, maintains its former rate of operation at its tin plate mills, but has tapered off slightly in sheet mill operations.

There is no certainty that the Steel Corporation will be able to maintain even approximately its present rate of operation for any length of time. The large mass of business the Steel Corporation accumulated on books last year has proved very sound except for a small volume of cancellations, much sounder than the independent steel producers expected would prove to be the case whenever the steel situation should turn easy, but that would not prevent the buyers from requesting that shipments be made at a slower rate. The consumer may be able and anxious to take every ton on his contract, but his rate of operation might be such as to require that deliveries originally intended

to be completed by June 30 should be strung out to December 31.

Prices

There is some price cutting in a number of the finished steel products, but the cutting does not amount to much in either volume or extent. As to volume, the Steel Corporation is probably booking more business than the independents, and of course its prices are absolutely firm, while some at least of the independents are holding strictly to regular prices, yet are booking an order here and there. As to extent, the maximum shading, where there is any at all, is probably only \$2 or \$3 a ton.

However, this does not indicate that present prices are going to hold. There is absolutely no prospect that they will. The point is that the time is not ripe. Some day there will be a readjustment in prices to a level that will suit buyers, on the basis of the general liquidation that is now in progress. No readjustment to the eventual bottom could be made now, for it is still to be ascertained how far costs of production can be reduced, and even if the mills could name bottom prices now they would be quite indisposed to do so since buyers would not take hold freely at this time no matter what prices were named, and there is a tactical advantage in holding off from making reductions, or at any rate the last of the reductions that will have to be made.

Wages

Possibly it is largely because mills do not consider it advantageous to reduce prices at this time that they are so slow in reducing wages. No employer pretends that wages should not come down, and by a large amount, yet less than half the independents, in point of capacity, have reduced wages to any noteworthy extent, while the Steel Corporation appears not even to have considered the matter. The steel producers doubtless feel that if there were such general reduction in wages buyers would at once clamour for much lower steel prices, and there might be more lost than gained. Particularly in the Pittsburgh and Youngstown districts wage reductions have been lacking, though of course there has been some reduction in wage costs, by less efficient men being let go, and by men previously drawing bonus or special wages being released, to be engaged afresh at standard rates.

Prices and Costs

That there is room, eventually, for

very considerable declines in prices is shown by the Steel Corporation's earnings reports. The year 1920 shows \$177,000,000 earnings, after allowance for all taxes including the federal income and excess profits taxes, and after paying interest on bonds of subsidiary companies. That is 10 per cent. more than the corporation's earnings in the best year before the war and about two and one-half times the earnings in the poorest year. Yet the corporation was greatly handicapped in 1920. It had an average operation of only about 82 per cent., while in 1916 it had a 100 per cent. operation. Its costs were high on account of conditions in general, and there was the particular disadvantage that the costs rose to an extent by sympathy with the high costs of the independent mills, the latter caring little about costs since they advanced their selling prices. The corporation got nothing by increased selling prices but lost something by increased costs. The independents used to claim that they had to have their high prices because they were at a disadvantage by comparison with the Steel Corporation, and when pressed for particulars the chief item they mentioned was "overhead," just what before the war it used to be said distinguished the Steel Corporation. How the tables came to be turned so suddenly has never been satisfactorily explained. There is room for suspicion that many of the references to the high overhead of the independents included large dividends, bonuses, etc., in overhead. Now the independents are largely idle, and they are forced to lose the alleged overhead.

Pig Iron and Coke

Valley foundry iron has become readily available at \$30, furnace, or \$1.50 decline, Bessemer and basic being altogether inactive and therefore remaining at \$32 and \$30 respectively. Most of the merchant furnaces are idle and the few in operation are facing the prospect of having to blow out.

The better balanced mentally of the merchant furnacemen are taking no interest in pig iron prices at this time. It is a matter of indifference whether the quotable market is one thing or another. What they are thinking of is costs. The costs will have to be reduced, there being confidence that when costs are made right the market will take care of itself. There is coke, for instance, now held at \$6.00 as a contract price, though odd lots for spot shipment can be picked up at \$5.00 or less. Two or three months ago the Connellsville coke operators were talking about holding out for one price or another, even prices higher than \$10, and keeping their ovens idle until furnacemen should become willing to step up to the counter and buy at the seller's idea. Now the coke operators are hoping for reductions in costs. They need hardly anything but two things, contentment with lower profits and lower wage rates.

BERTRAM AND PRATT & WHITNEY HELD THEIR SALES CONFERENCE

ON January 12, 13 and 14 the sales convention of the John Bertram and Pratt & Whitney Companies was held at Dundas, representatives being present from Montreal, New York, Halifax, Chicago, Winnipeg, Toronto, as well as a large number from Dundas.

This sales convention, which was a success in every way, was the first one held by the companies concerned, but it is the intention that it shall be an annual fixture in January of each year. Aside from the social part of the convention, which enabled the salesmen and managers to get better acquainted with each other and with the staff at Dundas, the papers and discussion which followed them in each case provided a valuable means for a free exchange of ideas, and enabled the salesmen to get the head office point of view and vice versa. The papers were, of course, all prepared in

advance, and a bound copy of each paper was made by means of a duplicating machine, and placed in the hands of each person attending the convention, before the opening of the sessions, which gave each one a chance to look over the subject and become sufficiently acquainted with the paper to discuss it intelligently. Many of the papers were illustrated by lantern slides, which added considerably to the value of the papers as it enabled the speakers to illustrate points which could not otherwise have been made clear.

Spoke of Earlier Days

A particularly interesting feature of the dinner on Thursday evening was Sir Alex. Bertram's address "Reminiscences," in connection with the founding of the Bertram plant by his father and the late Robert McKechnie. The dinner was held in the building which

was lately the rectory of St. James Church, and the fact that the building was for many years the residence of the late John Bertram and the early home of Sir Alex. and Henry Bertram, recalled many incidents of the early days which stirred the emotions of every man present.

Wednesday, the first day of the conference, was largely taken up with tours of inspection to the Bertram and Pratt & Whitney plants, and the demonstration of certain machine tools, with descriptive addresses on these by A. W. Draeseke. Mr. Sprague, principal of Hamilton Technical School, was the speaker at the evening session.

Thursday morning papers were given by H. W. Angold, on some of the shop methods and inspection at the Bertram plant; G. H. Howard discussed enquiries, quotations and orders, from the viewpoint of the head office, while H. G. Bertram dealt with "Order Department Requirements." Helpful discussions fol-

Continued on page 96

SALES CONFERENCE OF JOHN BERTRAM AND PRATT & WHITNEY CO. AT DUNDAS.



First Row, left to right—James Young, Montreal, W. J. Flaig, Chicago; Sir Alex. Bertram, Montreal; Henry Bertram, Dundas; E. L. Leeds, New York; H. G. Bertram, Dundas.

Second Row—A. Martin, Halifax; G. H. Howard, Dundas; A. M. Maver, Toronto; Douglas Robb, Winnipeg; A. W. Paquin, Montreal; J. Ferguson, Toronto.

Third Row—R. McKechnie, Windsor; H. W. Angold, Dundas; W. Davidson, Dundas; A. W. Draeseke, Dundas; C. E. Dickson, Dundas; C. A. Fisher, Dundas.

Fourth Row—H. W. Simpson, Dundas; T. Tolton, Dundas; W. J. Houghtling, Dundas; I. L. Ibbotson, Montreal; M. B. Davidson, Dundas; A. E. R. Turner, Dundas; T. A. Woods, Toronto.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	\$33 96
Lake Superior, charcoal, Chicago. 48 50	
Standard low phos., Philadelphia. 44 79	
Bessemer, Pittsburgh	33 96
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	43.64

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	\$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 50
Steel bars, base, Montreal	4 50
Reinforcing bars, base	4 75
Steel hoops	6 00
Tire steel	5 00
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 50
Chequered floor plate 3-16 and heavier	7 50
Bessemer rails, heavy, at mill.	
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	5 00
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds.	
	C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

METALS

	Gross.	
	Montreal	Toronto
Lake copper	\$19 00	\$19 50
Electric copper	18 50	19 00
Castings, copper	18 00	19 00
Tin	44 00	46 00
Spelter	8 00	9 00
Lead	7 25	8 00
Antimony	8 00	9 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	\$ 5 50	\$ 5 50
Plates, ¼ up	5 00	5 50

PIPE—WROUGHT

Standard Butt Weld Pipe
Per 100 Ft.

	Steel	Gen. Wrought Iron	
	Blk.	Galv.	Blk.
1½	\$ 6 50	8 70	5 01
1¼	5 31	7 41	4 31
1½	5 31	7 41	4 31
1½	7 10	8 63	7 96
1½	8 80	10 87	9 97
1	13 01	16 07	14 71

1½	17 60	21 74	19 90	24 04
1½	21 04	25 99	23 79	27 84
2	28 31	34 97	32 01	38 67
2½	44 75	55 28	.....	.....
3	58 52	72 29	.....	.....
3½	74 06	90 62	.....	.....
4	87 75	107 37	.....	.....

Standard Lapweld Pipe

Per 100 Ft.

	Steel	Gen. Wrought Iron	
	Blk.	Galv.	Blk.
2	\$32 01	\$ 38 67	\$35 71
2½	48 26	58 79	54 11
3	63 11	76 88	70 76
3½	75 90	92 46	85 10
4	89 93	107 55	100 83
4½	1 05	1 29	1 30
5	1 22	1 50	1 52
6	1 58	1 95	1 97
7	2 06	2 53	2 53
8	2 16	2 66	2 66
8	2 49	3 07	3 07
9	2 98	3 67	3 67
10	2 77	3 41	3 41
10	3 56	4 39	4 39

Prices—Ontario, Quebec and Maritime
Provinces

WROUGHT NIPPLES

4" and under, 60%.	
4½" and larger, 50%.	
4" and under, running thread, 30%.	
Standard couplings, 4-in. and under, 30%.	
Do., 4½" and larger, 10%.	

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds.	
	Montreal	Toronto
Copper, light	\$10 50	\$ 9 00
Copper, crucible	13 00	11 00
Copper, heavy	12 50	11 00
Copper wire	12 50	11 00
No. 1 machine composition	13 00	9 75
New brass cuttings	7 00	8 00
Red brass turnings	10 00	8 00
Yellow brass turnings	7 00	6 00
Light brass	5 00	5 00
Medium brass	6 50	6 00
Scrap zinc	5 00	4 00
Heavy lead	5 25	4 00
Tea lead	2 50	2 00
Aluminum	16 00	10 00

	Per Ton	
	Gross	Net
Boiler plate	\$11 00	\$12 00
Heavy melting steel	18 00	14 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	18 00	14 00
Malleable scrap	20 00	20 00
No. 1 machine cast iron	32 00	25 00
Pipe, wrought	8 50	8 00
Car wheel	30 00	25 00
Steel axles	20 00	18 00
Mach. shop turnings	8 00	6 00
Stove plate	23 00	20 00
Cast boring	8 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.	
	Net list	Net
Carriage bolts, 7-16 and up.	15	
Carriage bolts, ¾" and less	20	
Coach and lag screws	55	
Stove bolts	25	
Wrought washers	Net	
Elevator bolts	—5	
Machine bolts, 7-16 and over.	—30	
Machine bolts, ¾-in. and less.	Net	
Blank bolts	—5	
Bolt ends	27½	
Machine screws, fl. and rd. hd., steel		

Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add \$2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less.	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	\$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.	
	Net	Net
Set screws	—40	
Sq. and hex. hd. cap screws	—25	
Rd. and fil. hd. cap screws		
Flat but. hd. cap screws	+25	
Fin. and semi-fin. nuts up to 1-in.	12½	
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	15	
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net	
Studs	+5	
Taper pins	—12½	
Coupling bolts	+40	
Planer head bolts, without fillet, list	+45	
Planer head bolts, with fillet, list plus 10 and	+55	
Planer head bolt nuts, same as finished nuts.	net	
Planer bolt washers	+60	
Hollow set screws	30	
Collar screws	40	
Thumb screws	75	
Patch bolts	add +85	
Cold pressed nuts to 1½ in.	add \$1 00	
Cold pressed nuts over 1½ in.	add 2 00	

BILLETS

	Per gross ton	
	Gross	Net
Bessemer billets	\$60 00	
Open-hearth billets	60 00	
O.H. sheet bars	76 00	
Forging billets	56 00-75 00	
Wire rods	52 00-70 00	

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails, base	\$5 25
Cut nails, base	6 70
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10½
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 29
British Manila rope	0 28
New Zealand hemp	0 23

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net
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MISCELLANEOUS

Solder, strictly	\$ 0 27½
Solder, guaranteed	0 29½
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	20 35
Red dry lead, 100-lb. kegs, per cwt.	15 00
Gasoline, per gal., bulk	0 42
Pure turp., single bbls., gal. ...	3 15
Linseed oil, raw, single bbls. ...	2 37
Linseed oil, boiled, single bbls. ...	2 40
Wood alcohol, per gal.	4 00
Whiting, plain, per 100 lbs. ...	3 00

CARBON DRILLS AND REAMERS

S.S. drills, wire size	40 and 5
Can. carbon cutters, plus	10
Standard drills, all sizes	40 and 5
3-fluted drills, plus	10
Jobbers' and letter sizes	40 and 5
Bit stock	50
Ratchet drills	10
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Chucking reamers	Net
Hand reamers	10
High speed drills, list net to plus	20
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	\$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	70	80
Class B	24	34
Class C	16	24

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28...\$ 7 50	\$ 7 50	
Sheets, blue ann., No. 10	6 50	6 50
Canada plates, dull, 52 sheets	13 00	13 00
Can. plates, all bright..	14 00	
Apollo brand, 10¼ oz., galvanized		
Queen's Head, 28 B.W.G.	13 00	
Fleur-de-Lis, 28 B.W.G.	12 50	
Gorbal's Best, No. 28		
Colborne Crown, No. 28		
Premier, No. 28, U.S. ...	10 00	10 00
Premier, 10¾-oz.	10 50	10 40
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., \$13; 5-16, \$11; ¾ in., \$10; 7-16 in., \$9.80; ½ in., \$9.75; ⅞ in., \$9.20; ¾ in., \$9.30; ⅝ in., \$9.50; 1 in., \$9.10; Extra for B.B. Chain, \$1.20; Extra for B.B.B. Chain, \$1.80.
--

ELECTRIC WELD COIL CHAIN B.B.

¾ in., \$16.75; 3-16 in., \$15.40; ¼ in., \$13; 5-16 in., \$11; ¾ in., \$10; 7-16 in., \$9.80; ½ in., \$9.75; ⅝ in., \$9.50; ¾ in., \$9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	\$27 00	\$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in. ....	.....	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	19

BELTING—No. 1 OAK TANNED

Extra heavy, single and double ...	6½
Standard	6½
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	\$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft. ...	3 50

PLATING SUPPLIES

Polishing wheels, felt	\$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¼
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

WASTE

XXX Extra ..23	Atlas ....19
Peerless ....22	X Empire ...18½
Grand ....21½	Ideal ....18
Superior ....21½	X Press ....17
X L C R ....20	

Colored

Lion ....16	Popular ..12
Standard ....14	Keen ....10
No. 1 ....14	

Wool Packing

Arrow ....35	Anvil ....22
Axle ....28	Anchor ....17

Washed Wipers

Select White..20	Dark colored.09
Mixed colored.10	

This list subject to trade discount for quantity.

RUBBER BELTING

Standard10% Best grades..15%

ANODES

Nickel ....	.55 to .60
Copper .....	.38 to .40
Tin .....	.70 to .70
Zinc .....	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	\$35 00	\$37 00
Copper wire, list plus 10 ..		
Plain sheets, 14 oz., 14x60 in.	40 00	44 00
Copper sheet, tinned, 14 x 60, 14 oz.	43 00	46 00
Copper sheet, planished, 16 oz. base	47 00	50 00
Braziers', in sheets, 6 x 4 base	39 00	42 00

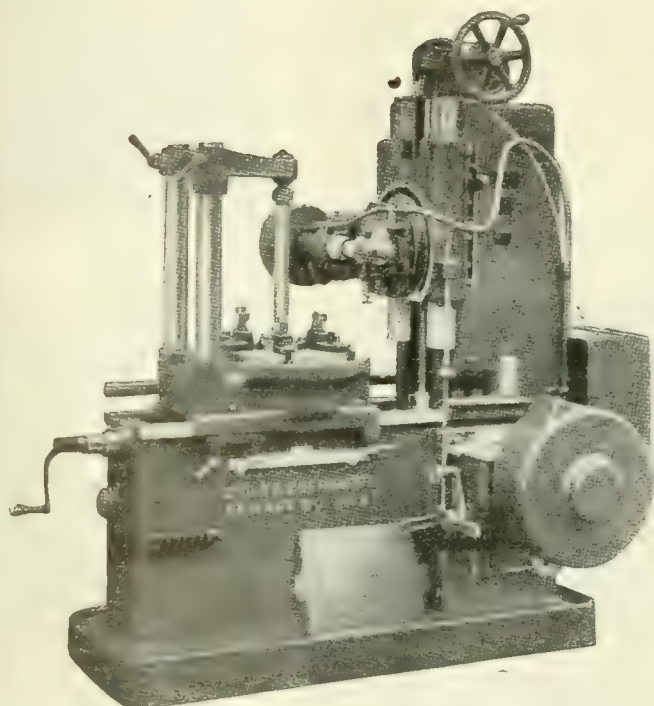
LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	\$10 50	\$14 50
Sheets, 3½ lbs. sq. ft. ...	10 25	14 00
Sheets, 4 to 6 lbs. sq. ft. ...	10 00	13 50
Cut sheets, ½c per lb. extra.		
Cut sheets to size, 1c per lb. extra.		

PLATING CHEMICALS

Acid, boracic	\$.23
Acid, hydrochloric .....	.04¾
Acid, nitric .....	.11
Acid, sulphuric .....	.04½
Ammonia, aqua .....	.15¾
Ammonium, carbonate .....	.23
Ammonium, chloride .....	.22
Ammonium, hydrosulphuret .....	.75
Ammonium sulphate .....	.30
Arsenic, white .....	.16
Copper, carbonate, annhy. ....	.41
Copper, sulphate .....	.13
Cobalt, sulphate .....	.20
Iron perchloride .....	.62
Lead acetate .....	.30
Nickel ammonium sulphate .....	.20
Nickel carbonate .....	.32
Nickel sulphate .....	.20
Potassium sulphide (substitute). ..	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate .....	.13
Sodium carbonate crystals .....	.04
Sodium cyanide, 127-130% .....	.39
Sodium hyposulphite per 100 lbs. ...	9.00
Sodium phosphate .....	.15
Tin chloride .....	.30
Zinc chloride, C.P. ....	.30
Zinc sulphate .....	.08

Prices per lb. unless otherwise stated



Gould & Eberhardt GEAR HOBBERS

are

Automatic therefore Economical

If you cut gears in quantities they can be cut with advantage on G. & E. Gear Cutting Machinery.

For gears up to 120" dia.

Catalog describing full line of Gear-cutting, Hobbing and Rack-cutting machines on request.

Write for prices and deliveries

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

If It's Machinery—Write "Williams"

64 Front Street West
TORONTO

They must be getting results—

or why would they continue to advertise each week? That's logic, isn't it? Have you noticed that each week the same advertisements appear? If you don't care to use large space, insert a "tickler" ad.

CANADIAN MACHINERY
143-153 University Ave., Toronto, Ont.

CARBONS *for electric arc welding*

*Correspondence
Invited*

THE ELECTRIC WELDING INDUSTRY has been tremendously advanced by the high development of arc carbons for specific purposes. We manufacture the following grades, named in the order of their current carrying capacities:

PLAIN WELDING CARBON:

A hard carbon for ordinary service.

COLUMBIA WELDING CARBON:

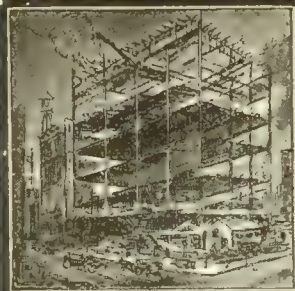
Very hard. It can also be furnished copper coated, making it suitable for use as a cutting electrode as well as for heavy welding work.

SPECIAL GRAPHITE WELDING CARBON:

Rather soft and graphitic. High conductivity. Used where a high amperage is required. Used with excellent results on general work.

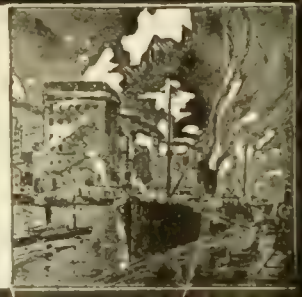
CANADIAN NATIONAL CARBON CO., LIMITED, Hillcrest Park, Toronto

7421



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



READY FOR THE EXPORT TRADE

**International Malleable at Guelph Put
in Plant to Machine Castings**

The International Malleable Iron Company, Guelph, have installed, in an addition to their plant, complete equipment for the machining of their malleable and cast iron pipe fittings and malleable and gray iron castings. This plant has practically doubled in capacity in the last five years. The company's sales organization includes the following representatives: Halifax, Geo. D. Hatfield, Bedford Chambers; St. John, N.B., H. G. Rogers, 147 Prince William Street; Winnipeg, Harry F. Moulden & Son, Confederation Life Building; Vancouver, Cyril Ames, Wilton Block. The Toronto and Montreal fields are taken care of from the head office, Guelph. Arrangements are being made whereby the company will be capably represented in the development of fittings business in foreign markets.

PLENTY OF ORDERS AT THIS PLANT

At the annual meeting of the Canadian Car and Foundry Company, W. W. Butler stated he had been disappointed in the showing for the past year, as he had expected to report greater profits. Business had been curtailed by strikes, the car embargo, and difficulties in obtaining material, with the result that only 1,700 cars had been turned out, despite large orders on the books. Most of the profits for the year were the result of the company's production of specialties. He pointed out in this connection that the company was the most self-contained car plant in the world, and manufactured more of its own requirements than any other plant in existence.

Fifty-five hundred cars had been carried over on the books, which exceeded any previous year. The company had on its books at the commencement of its present fiscal year orders in excess of \$26,000,000, as compared with about \$8,000,000 at the start of the previous year. At present the company has \$14,000,000 in orders on its books, enough to keep the company going for some time.

CHANGES MADE AT WILLYS-OVERLAND

**J. R. Marlow to be Secretary-Treasurer
—Mr. Burt Goes to Syracuse**

Several changes have taken place in the personnel of Willys-Overland Limited. J. R. Marlow has been promoted from the position of Montreal branch manager to be secretary and treasurer of the company. As he will also have supervision of sales generally, Mr. Marlow will take over many of the duties formerly performed by Mr. MacKay and Mr. Dover. His appointment follows Mr. Burt's transfer to one of Overland's



J. R. MARLOW.

Appointed Secretary and Treasurer of the
Willys-Overland Co., Toronto.

allied industries, the New Process Gear Company, of Syracuse, N.Y. When T. A. Russell, president of Willys-Overland Limited, announced the appointment of C. R. Burt as general manager, it was part of the arrangement with Mr. Willys and Mr. Chrysler that Mr. Burt would return to the United States later in the present year. Owing to developments earlier than expected, it was found advisable for Mr. Burt to assume the management of the gear company in January. Formerly sales manager of the Russell Motor Car Company in Toronto, Mr. Marlow went to Montreal in 1915 to take charge of the then Russell Motor Car Company branch. This branch was taken over as a branch of Willys-Overland Limited in 1917 and Mr. Marlow continued as manager.

NEW SALES FORCE NOW ORGANIZED

Considerable interest is being shown in the forthcoming organization of what will be known as the Dominion Industrial Products Co., Ltd. This concern will be the accredited Canadian representatives of some thirty or more United States manufacturers of numerous industrial products.

The products handled range from industrial railway equipment, and road contractors' equipment and supplies to various metal specialties, i.e., machine screws, bolts, nuts, washers, special nails, escutcheon pins and screw machine products in all metals. Non-ferrous metals, steel sheets, bars shapes, etc., will be dealt in, as also will certain types of foundry equipment and supplies.

It is not expected that warehouses will be maintained before the end of the year, but there are immediate prospects of sales offices being opened in the principal Canadian cities this year.

Those connected with the enterprise include W. P. Young, formerly general purchasing agent of the Canadian Edison Appliance Co., Ltd., of Stratford, and the Canadian General Electric Co., Ltd.; J. M. Young, formerly connected with the Russell Motor Car Co., Ltd., and the Machine & Stamping Co., Ltd. James W. Derbyshire will be general sales manager, and a fairly large sales staff will be engaged, as the Dominion Industrial Products Co., Ltd., is Dominion-wide in its scope.

APPOINTED NOW AS SALES MANAGER

**G. F. Morris Started as an Apprentice
Machinist with Business Machines**

Announcement has been made of the appointment of G. F. Morris to the position of sales manager of the time recording division of the International Business Machines Company, Limited, Toronto. Mr. Morris' connection with the company has extended over a period of ten years. He started as an apprentice machinist with the International Time Recording Company, Limited, in 1909 when International time recorders were first manufactured in Canada. When F. E. Mutton became general

(Continued on page 99)

THE WORLD CALLS

NEVER BEFORE, AS NOW, HAS THE WHOLE WORLD CALLED "PRODUCTION"

Are you doing any Screw Thread Cutting?

How are you doing it?

Do you know that Geometric Thread Cutting Tools have effected an enormous saving of time and costs in many thousand shops?

The first step is to investigate. Tell us the job you have to do, and hear what we can do for you.



THE FINAL SHIPMENT OF THE DAY--THE FREIGHT SHIPMENT

Express -- *Parcel Post* -- *Mail* -- *Freight*

These are the four channels by which Geometric Screw Thread Cutting Tools and Machines are shipped.

There is no place where more business is done to the square foot than in our Shipping Department, because of the demand for Production Tools—Automatic Die Heads and Collapsing Taps—everything for more and better screw threads.

Make Screw Thread Cutting the Most Satisfactory Operation in Your Shop.

—Write—

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B., Halifax, N.S.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

The Week's Events in Montreal Industry

The Dominion Bridge Company, of Montreal, held their second annual reception and dance at the Windsor Hotel last week, when about 600 were present, including the president, G. H. Duggan, and a number of directors and representatives from the branch offices and plants.

Owing to the falling off in orders the management of the Canadian Steel Foundries are contemplating the closing down of the Longue Pointe plant for a period of several weeks. The car division of the company's activities is fairly active but curtailment has been made in other departments.

The C. P. R. Angus shops in Montreal, are still working on the 8-hour 5-day schedule, with practically the same staff as before the holidays. A slight change has been made in respect to starting and stopping, the works opening one hour earlier on account of the increasing daylight.

At the forthcoming annual meeting of the Engineering Institute of Canada it is expected that J. M. R. Fairbairn, chief engineer of the C. P. R., will be elected to the office of president for the ensuing term, succeeding R. A. Ross, who retires at this time. Mr. Fairbairn has been connected with the head office of the C. P. R. in Montreal for the past twenty years.

One man, Alfred Robson, was killed, and three others seriously injured, by the explosion of a quantity of old flash powder thrown into the furnace at the plant of the National Drug Company in Montreal. The small quantity first thrown in flashed back and ignited the remainder held in the hands of Robson, who was also blown to pieces by the force of the explosion. Slight damage was done to the boiler and building.

The death of W. J. Moule, assistant comptroller of the Canadian Pacific Railway removed another well known official of the railway company. For three weeks before his death Mr. Moule suffered from sleeping sickness. Mr. Moule spent his entire career with the C. P. R., starting as a young office clerk back in 1891, and gradually advancing to more responsible positions until he became assistant comptroller in 1918.

J. V. Robinson, inventor of the original Robinson train connector, has taken action against his brother, E. A. Robinson, of Montreal, for the marketing of a similar device, this, it is claimed, being contrary to agreement. E. A. Robinson claims that he severed his connection

with the original company, and that the improved connector has been developed since that time, and that any restrictions placed upon it would be detrimental to the public interest. Judgment has been reserved.

An interesting demonstration of a forest tractor, manufactured by the Renault Company of France was given by H. Thiebaut, the Canadian agent in Montreal, before a number of engineers and interested parties, early this week in Montreal. The tractor is a modification of the war tank and is especially adapted to work in field and farm, forestry work and mountain transport, and the drawing of trucks and the towing of barges. A similar demonstration will be held, later in the week, before the representatives of the Montreal Harbor Commissioners.

An interesting incident in connection with industrial inactivity was noted last week in Montreal, when a casual visit to the old plant of the John McDougall Caledonia Iron Works brought to light the fact that all the old patterns were being disposed of at the remarkably low figure of \$3.50 per load. The McDougall firm went out of business about a year ago, and this industrial firm was one of the oldest of its kind in the Dominion. In the days of ascendancy this load of "firewood" would represent an outlay of tens of thousands of dollars.

The Blashill Wire Machinery Company of Montreal are looking for a location to establish a plant for the making of wire fencing. A. E. Blashill is the designer of a new type of fence making machine, and the company had contemplated a manufacturing move a couple of years ago, but owing to the difficulty of securing raw materials, the enterprise was temporarily abandoned, but with the conditions for the securing of wire product much improved, the plans are again under way, and it is expected that the company will be making fence before the early summer.

The eighteenth annual banquet of the Canadian Railway Club was held at the Windsor Hotel, in Montreal, on the last Saturday in January, and proved to be one of the best attended and most successful in the history of the club. The chair was occupied by W. H. Winterrowd, chief mechanical engineer of the C. P. R., and the speaker of the evening was the Hon. F. B. Carvell, chairman of the Board of Railway Commissioners. Other speakers were Dr. Stephen Leacock of McGill University; W. W. Butler, president of the Canadian Car and Foundry Company, and others. The en-

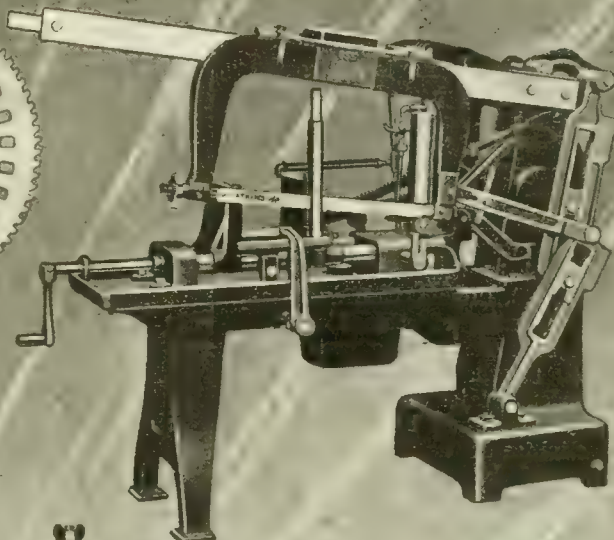
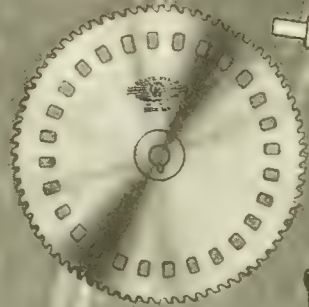
tertainment committee provided an excellent program of musical and vaudeville talent.

This week will see the commencement of the sittings in Montreal in connection with the arbitration board which will decide the present value of the Grand Trunk Railway, and the amount the Canadian Government will have to pay for the acquisition of the holdings of the road. It is expected that the proceedings will occupy nearly three months. The Board will be presided over by Sir Walter Cassels, of the Exchequer Court of Canada; Sir Thos. White will represent the Government, and ex-president W. H. Taft will look after the interests of the Grand Trunk shareholders. Associated with these will be a long array of lawyers, engineers and experts.

Speaking before the Canadian Railway Club, at their recent banquet, the Hon. F. B. Carvell, chairman of the Board of Railway Commissioners, emphasized the fact that rates on railways, whether private or Government owned, must be sufficient to pay a reasonable profit over and above operating expenses. "Only one set of rates can be used for all railroads," said Mr. Carvell. "You must face conditions as you find them. The Government must consider the C.N.R., as well as the C.P.R., and it is the duty of all public bodies to support the C.N.R. I was always opposed to it as many others were. But whether we favor Government ownership or not, we have it, and within a year more than half the railways in Canada will be under Government ownership. I am not so sure that it was necessary to take over the Grand Trunk, but we have these lines, and the people must face the situation. I would impress upon the employees of the national system that they must give the same efficient service as those of the C. P. R., forgetting the common idea of those serving Government owned businesses."

New Power Plant.—A Niagara River water works project, jointly controlled by the United States and Canada and utilizing all the power developed from the river, was proposed to the Federal Power Commission at Washington by Peter A. Porter, of Niagara Falls, and T. Kennard Thomson, of New York City. The project would include a dam across the gorge below the falls and a tunnel under Goat Island and practically would eliminate all other projects. Proponents of the plan claim that it would be more economic and efficient than a number of small projects.

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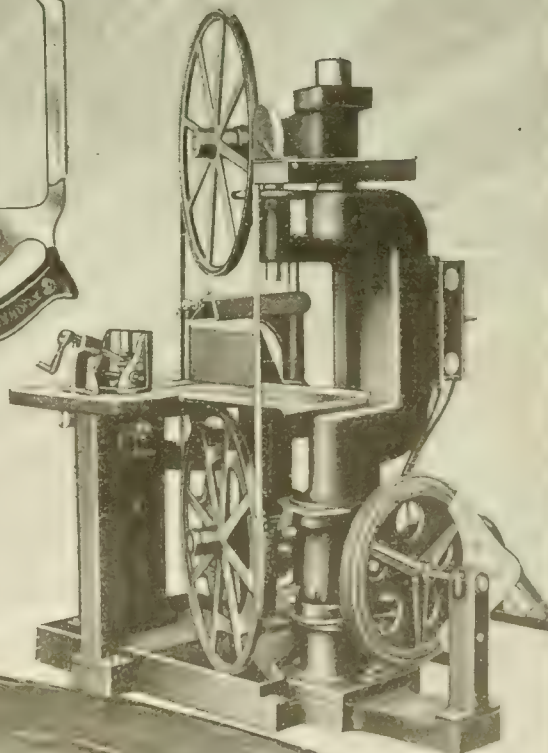
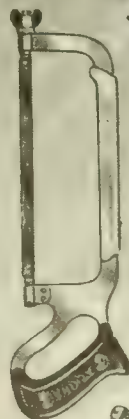
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"The Sterling Quality Saw People"

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Branch:
VANCOUVER, B. C.



ATKINS ALWAYS AHEAD
AAA

Selling British Made Goods in Canadian Market

Strong Organization to Take Up Matter of Fraudulent Trade-marks—Montreal Speaker Believes That Tide Has Turned, And
-Feeling of Stability in Values Can Bring Business Revival.

ANOTHER step in bringing the Montreal and Toronto branches of the Canadian Association of British Manufacturers and their representatives closer together was taken at the annual meeting of the Toronto branch at the King Edward Hotel on January 28. Greetings were brought from the Montreal branch by Messrs. F. I. Spielman and John E. Ritchie, first and second vice-presidents of the Montreal branch, and both the retiring president, Mr. Geo. A. Marshall, and the newly-elected president, Major John Harris, intimated that steps would be taken to extend the activities of the organization to other centres of the Dominion.

Following luncheon in the banquet room, at which Mr. George A. Marshall presided, Secretary Bunney read the minutes of the last annual meeting. Treasurer Sharpe reported on the financial condition, showing a favorable balance in the treasury. A number of necessary changes in the constitution were left to the council to dispose of, these having been practically agreed upon by the Montreal and Toronto branches.

The President's Address

Mr. Marshall, in his annual report, gave a very thorough resume of the work of the association, both in Toronto and Montreal, the Montreal annual meeting having been held on January 21. The work of the two associations being reviewed in this manner gave a wider scope of the activities of the organization.

"The association," said Mr. Marshall, "which was established in the early part of 1919 on the initiative of H. M. Trade Commissioners in Montreal and Toronto, has now a membership of over 200 representatives of the British trade in the Dominion of Canada, which development is due to your branch council members, trade section committees, and the valued assistance rendered through the good offices of H. M. trade commissioners. As outlined in our last annual report, the association, as members, has been strengthened considerably by the Federation of British Industries, which is an extensive organization dealing with British manufactures all over the world. They are in touch with chambers of commerce and boards of trade in all industrial centres, and we cannot too highly credit them with appreciation of their valuable assistance this past year to our association both as regards useful correspondence exchanged, and in the manner our suggestions are dealt with. In order of reciprocity the position is now better to extend to them our knowledge



MAJOR JOHN HARRIS.

President Canadian Association of British Manufacturers. Came to Canada in 1914 and saw military service in the Great War, rising from lieutenant to major. Decorated by the President of France. Also in South African War. Keenly interested in British trade in Canada.

of any British firm desirous of purchasing in this country, and information relating to the Canadian markets. Several of our members when visiting England have called at their London office, 39 St. James St., S.W. 1, with very satisfactory results. In this connection alone it should be an incentive to double our membership, as the governing authority of such an enormous organization is, in time, bound to prove beneficial to our mutual interests.

Central Office

For the purpose of co-ordinating the business of the Montreal and Toronto branches, especially in dealing with overseas correspondence, it was unanimously decided by your respective councils to establish a central office at 39 Richmond St. East, Toronto, which is now suitably furnished in order to afford greater convenience and accommodation for businessmen interested in British manufacturers, and who wish to get in touch with the Association.

Excise Taxes

When the new excise taxes were enforced this association added its protest to those of other representative bodies, as a result of which modifications were made to advantage of the importers of British-made goods.

Customs Valuation of Invoices

During the past year the question of the value of invoices for duty purposes arose, and in order to meet the suggestions from various members a deputation consisting of Montreal and Toronto branches waited upon the commissioner of customs at Ottawa, with the result that the authorities decided in July last to accept for the purpose of appraising duty the pound sterling at the current rate of exchange. This is one achievement which the members, their customers and the British exporter should appreciate, and I consider this action alone should justify the association's existence.

Chamber of Commerce

A welcome was extended by this association to the deputation of the Allied Chamber of Commerce of the Empire who visited this Dominion in September last, and a communication was received from Lord Desborough, president of the Imperial Chamber, thanking the association and regretting the short duration of their stay with the many calls made upon the delegates would not permit of a special meeting being held.

Meetings

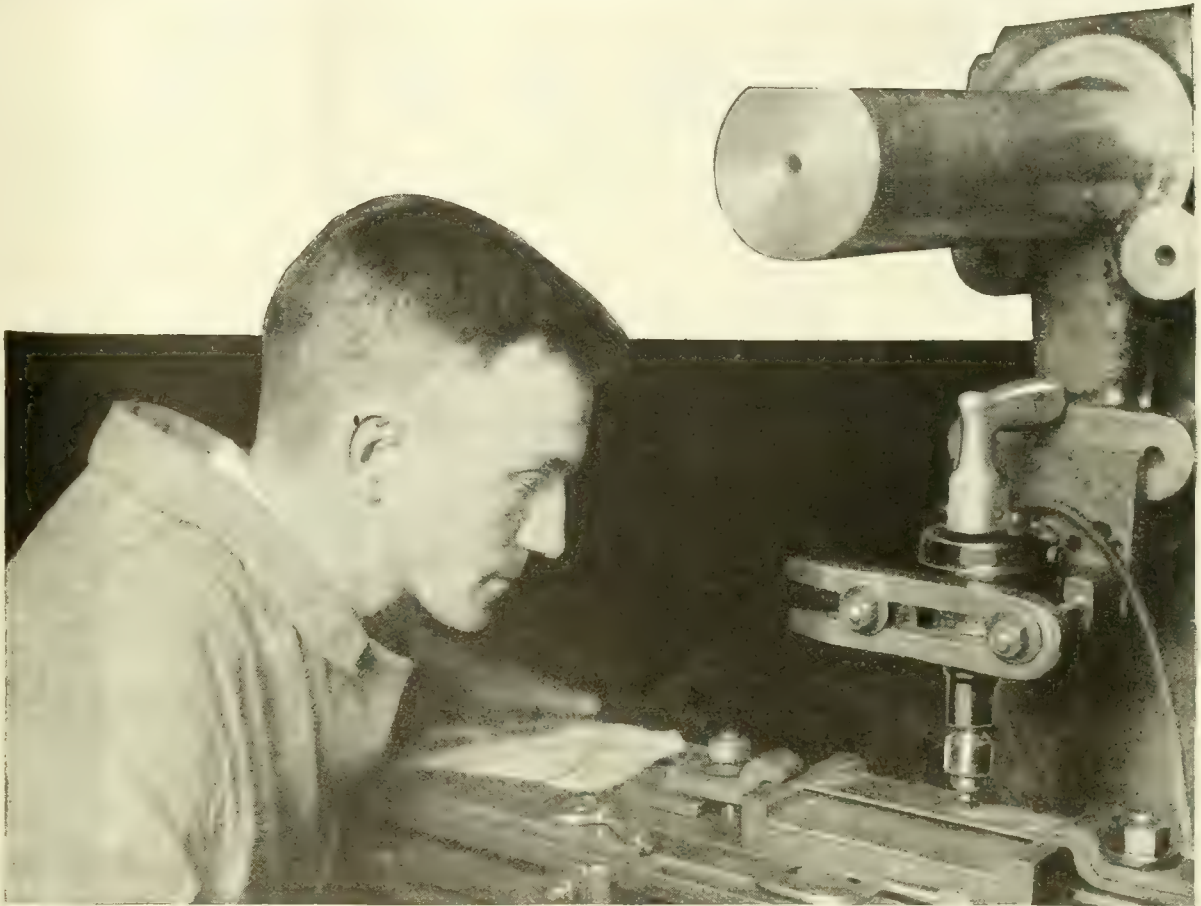
During the year we held 17 branch council meetings, 14 trade section meetings and made three visits to Montreal council.

Trade Sections

The trade sections are now well organized and show great improvement, especially the Textile section, consisting of the most members, with Harold Wilson as chairman. This section deserves special mention as it has been exceedingly active and of much assistance to the trade generally, inasmuch as it has provided for a Board of Arbitration to deal with disputes arising. They have also dealt satisfactorily with cases concerning cancellations and other important matters in the interest of every member connected herewith.

Publicity Committee

The Publicity Committee, for which C. W. Beal is responsible, also must not be overlooked. A booklet entitled "Sales-Craft," published periodically by the association for the benefit of members and their principals, with the object of distributing broadcast, contains useful information. Two editions already have been prepared and printed, one dealing with the steel trade and the other with the textile trade, copies of which have been mailed to members and various overseas associations with a view of in-



Yankee Ingenuity Solves Drilling Problems with the Aid of this Dumore High Speed Drill

John Bath & Company, Inc. (Worcester, Mass.)—maker of fine tools—uses a half dozen each of Dumore Drills and Grinders in his up-to-date shop.

The Photograph shows a Dumore Drill mounted on the overarm of a milling machine drilling holes in a tool steel jig plate $\frac{1}{8}$ " thick. There are 76 holes spaced .080" apart in sev-

eral rows and a drill .051" in diameter is used.

Dumore Drills—like the well known Dumore Grinders—are accurately built, with an almost unlimited range of application. Used to supplement the work of big machines, Dumore High Speed Drills add to the capacity of the shop and cut production costs on many classes of work.

Send for the details of Dumore High Speed Drills and Grinders. Let us show you how you can use them to advantage.

WISCONSIN ELECTRIC COMPANY, 2932 Sixteenth Street - Racine, Wisconsin

DUMORE PORTABLE DRILLS

creasing British trade in Canada and stimulating our aim.

Advertising

Through the courtesy and good offices of H. M. trade commissioners we were enabled to exhibit at the Canadian National Exhibition last year advertising matter from various members of the association, and in addition, distribute 10,000 printed blotters advocating closer trade within the Empire and British-made goods. I should like to tender our thanks to H. M. trade commissioners in Canada for their sound advice and cheerful suggestions at all times given for the welfare of the Canadian Association of British Manufacturers.

Appointments of Agents in U. S. for Canada

The association has taken up most energetically with the Federation of British Industries the question of appointment of agents in the United States for the Dominion of Canada. As evidence that this matter has received the attention it deserves, we would point out that during November last the matter was brought up in the British House of Commons. Whether any further action will be taken or not, attention has been called to this regrettable and inefficient policy.

General

The question of the newspapers printing the times of departure of English mails in a prominent place, a request for the provision of late fee-boxes in Montreal, and the standardization of catalogues and printed matter of uniform size have all received careful attention of your councils.

No doubt you will be pleased to learn from the recent returns at Ottawa of the enormous increase during 1920 over 1919 in the imports from the United Kingdom to Canada. In the year 1919 only \$87,659,198.00 worth of goods were brought in from the British Isles, whereas in 1920 the amount reads \$231,479,294.00.

As ex-president I shall take my seat on the council of this branch for another year, during which time I shall endeavor to act with as much pleasure and interest as before, and give the council all the support possible, and in conclusion would like to express my grateful appreciation of the valuable assistance rendered me by your vice-president, Major John Harris, and the members of the council, with whom our business relationship has always been most friendly."

Election of Officers

The election of officers resulted as follows:

President of both Montreal and Toronto branches, Major John Harris.

First vice-president of Toronto branch, C. W. Beal.

Second vice-president, Harold Wilson.

The president of the two organizations, Toronto and Montreal, is elected alternately from these places, the selection coming this year to Toronto as it had

the greatest paid-up membership. Members of the Toronto council were elected as follows: Messrs. R. D. Harling, W. G. Patrick, W. Bruce Morrow, Arthur C. King, R. W. Paton, James Haywood and John Wilson.

President-elect Harris, on taking the chair, was given a hearty round of applause. In a few words he thanked the members for the honor shown him, paying a tribute to the pleasant relationships that had been formed with the other members of the council during his tenure of the office of vice-president.

Other business included the appointment of George A. Touche & Co. as auditors for the association, with Mr. Sharpe for the local organization.

Mr. John Wilson extended a welcome to the visitors from Montreal, assuring them of the desire of the Toronto branch to work closely in touch with them.

Montreal Visitors Speak

Mr. F. I. Speilman, first vice-president of the Montreal branch, assured the gathering that he had felt the warmth of the Toronto welcome in a very real way, for when he left home it was ten below zero, and when he reached Toronto there were no signs of winter, "and I even noticed an absence of that white covering which is emblematic of the innocence and purity of Montreal." (Laughter). "I congratulate the new president and can promise him the support of the Montreal branch. There is a very desirable cohesion between the two organizations now. Formerly they were two, but now they are one, and we hope in the course of time to go ahead with further developments in other cities. The association is now recognized at Ottawa, and we had an opportunity to appear before the tariff commission a short time ago." Mr. Speilman also stated that they found it much easier getting appointments with the government at Ottawa now to present their views on various matters.

Mr. John E. Ritchie, second vice-president of the Montreal branch, pointed out that the textile men, especially during the last six months, had had some pretty serious times, but he believed the worst of it was over. He had words of counsel for the press of the country, claiming that they had in some cases led the public to expect larger reductions than were possible, although he was pleased to see they had mended their ways since. "Confidence is the main foundation of business," he stated, "and we believe it is being restored. In Montreal we are going out and asking for business now and we are getting it. What we need now is stability of prices. Any more reductions in textiles will have to be gradual. Prices took some six years to rise to present levels, and they are not going to come down overnight." Mr. Ritchie referred to a move that was being worked out by Mr. Wilson from Ottawa regarding duties from countries where money was at a discount or premium.

The pound sterling was at a discount so he would add 20 per cent. or so to equalize, and Canadian money being discounted in United States, there would be a reduction of the discount, the result being to reverse the British preference in Canadian tariffs.

Other Matters Discussed

Mr. Sturgeon brought up the matter of securing more publicity for British-made goods, and also pointed out that the words British or England were often used on articles that never saw that country. "I have often seen goods marked 'Old English' that had never been made in England."

President Harris said the council had taken this matter up before, as several complaints had been made, and the matter would be taken to Ottawa to find out what could be done. He instanced one article that was made in Philadelphia and marked "Old English." They were going to try and have such trade marks deleted. Mr. Speilman also referred to several instances in Montreal, one very recently where a charge had been made in the papers that German dyes in English packages were being shipped to United States. This rumor they quickly denied by a letter to the English press of Montreal.

Before the meeting adjourned reference was made by several members to the work of Mr. George A. Marshall as president and also to the able assistance of other officials.

BERTRAM AND PRATT & WHITNEY HELD THEIR SALES CONFERENCE

Continued from page 86

lowed all these papers. Thursday afternoon was opened by Mr. Leeds' address on Niles, Bement, Pond products, followed by Mr. Flaig on the Pratt & Whitney lines. "Advertising" and "Branch Office Systems" were dealt with by C. E. Dickson, Mr. Robb also giving a paper on the former subject. C. A. Fisher went into considerable detail on the design and manufacture of Pratt & Whitney small tools. A dinner was held in the evening at which the address of Sir Alex. Bertram, referred to previously, was the feature.

On Friday morning sales methods were discussed by M. B. Davidson and James Young, interest also being added by the presence of Mr. Smith, of Cleveland, who represented the Acme Machinery Company. The afternoon was also taken up with sales talks and a general review of the sales policy of the company.

New Company. — Incorporation has been granted to the Super Charge Engineering Company, of Canada, Ltd., with head office at Montreal and incorporation of 2,000,000 dollars. The company has been incorporated to manufacture, purchase, lease or deal in motors, tools, engines, machines, electric and mechanical fixtures, etc.

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*Also
Largest
Manufacturers in
the Dominion of
Set and Cap
Screws and
Semi-finish
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**It's easy for you to order by the name---
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DRINKING CUPS ARE UNSANITARY but the "Puro" serves clean, fresh water at a rate of 15 per cent to 25 per cent in water bill.

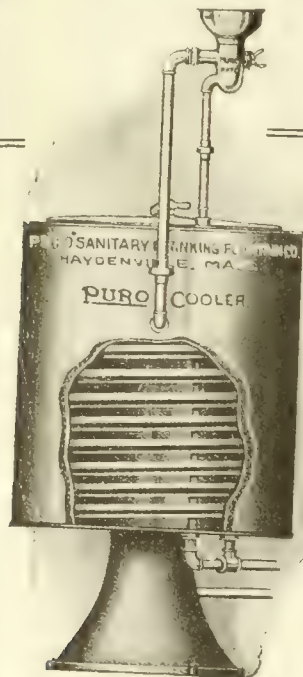
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THE KIMBER & HILLIER MFG. CO.,
Thorold Road, - St. Catharines, Ont.

THE EFFECT OF RELATIVE HUMIDITY

(Continued from page 78)

If such an adjustment was made when the relative humidity was 20% and a subsequent change in the weather conditions produced a relative humidity of say 90%, while the power to be transmitted remained the same, it is apparent that the sum of the tensions must decrease. Since the difference in tensions remains the same while the sum decreases, it is evident that the ratio T_1/T_2 must increase. Fig. 6 shows this variation quite clearly, and at the higher humidities this ratio reaches a value where the belt is in great danger of slipping.

On the other hand, suppose that the belt was set to standard conditions when the relative humidity was 90% and subsequently the atmosphere dried. The belt would then become far too tight, not only working at too high a stress, but also producing excessive pressure on the bearings. Fig. 7 shows this effect very clearly.

If care were taken to allow for the effect of a change of the relative humidity, or if the adjustment were made when the humidity was 55% then no change of humidity that would occur would either tighten or slacken the belt in a degree that would be likely to give any trouble. Fig. 8 shows the effect on both the ratio and the sum of the tensions.

All of the preceding work is at a temperature of 70°F. and as the higher humidities are apt to occur at temperatures above 70° and the lower humidities below 70° it was thought best to extend the field of investigation by varying the temperature. Accordingly a series of experiments was made at 50°F. with the relative humidity varying from 20% to 90%. Another series with the temperature 90°F. was carried out.

The sum of the tensions, and also the horse power, was constant for all of these tests. The results of these tests are shown in Fig. 9, which also has the results for 70°F. from the previous experiments.

If a belt can be fitted with a spring or gravity tightener, so called, a load probably fifty per cent greater can be carried without danger of stretching the belt, slipping or excessive pressure on the bearings.

Start Warehouse.—H. W. Byrne, 39 Duke Street, St. Catharines, dealer in new and second-hand machinery, proposes to open a warehouse in that city within the next month.

HAMILTON ENGINEERING SERVICE LIMITED

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Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.

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Personal

Mr. Reeves, of John Inglis & Company, is in Europe on business in the firm's interests.

The death occurred of Thomas Worrell, aged 54, at his home, 39 Beverley Street, Toronto. Born in England, he had been in Canada since a boy. For the past twelve years he had been foreman of the machine shops at the Pendrith Machinery Company's works.

One of St. Catharines' esteemed residents and a valued employee of the Welland Vale Manufacturing Company passed away suddenly, Nicklin Nicholas Bulger. The deceased, who was in his 58th year, returned from work and shortly after was stricken and passed away. The late Mr. Bulger was born in Montreal, and came to this city as a boy. He had been an employee of the Welland Vale Manufacturing Company for the past thirty years and was superintendent of the plant.

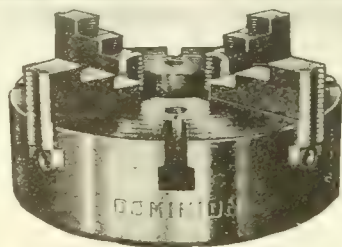
H. E. Brasier is now Ontario sales manager of the Willys-Overland Company. He has been handling the service department since 1914. Mr. Brasier is a native of Peterboro but came to Toronto as a boy. His first work was with the Massey-Harris bicycle department and he was with the Canada Cycle & Motor Company from 1900 until 1904, when he joined the American Abell Engine and Thresher Company as chief accountant. He remained there until 1912, when he became accountant at the Toronto branch of the Russell Motor Car Company.

APPOINTED NOW AS SALES MANAGER

(Continued from page 90)

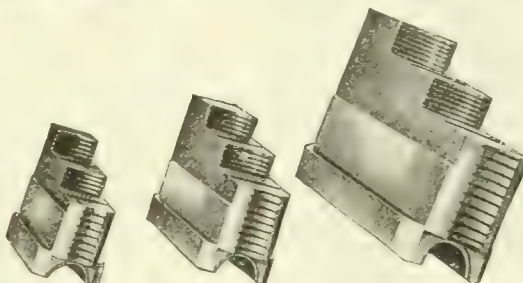
manager of the International Time Recording Company in 1915 Mr. Morris was placed in charge of the time recorder service department at Montreal. It was here that he graduated as a salesman and after a short time spent in Montreal and Toronto in this capacity was appointed sales agent for time recorders in Manitoba and Saskatchewan. At the time the International Business Machines Company, Limited, was organized in 1917, comprising the International Time Recording Company, Dayton Computing Scale Company and Tabulating Machine Company, Mr. Morris made a study of the tabulating machine business and was appointed subsequently representative of this branch of the company's interests in Western Canada. In August of last year he was called to the head office in Toronto to assume the duties of assistant to Mr. Mutton, vice-president and general manager.

His appointment as sales manager of the time recorder division was announced at the convention which the company held January 3-8.



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BUILT FOR HEAVY DUTY



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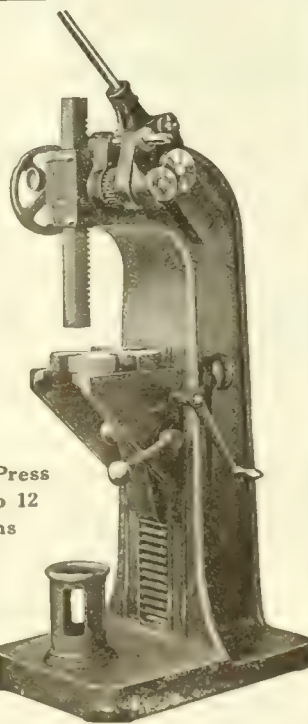
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brand costs less
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has a positive
grip on the pulley
and is true run-
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3—28" x 12' Boye & Emmes, 3 step cone, D.B.G., Q.C.G.
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 6—24" x 12' Boye & Emmes, 3 step cone, D.B.G., Q.C.G.
 1—24" x 12' Rahn Larmon, 3 step cone, S.B.G., Q.C.G.
 3—24" x 10' Boye & Emmes, 3 step cone, D.B.G., Q.C.G.
 1—22" x 10' Devenport, 3 step cone, D.B.G., Q.C.G.
 1—18" x 8' Greaves Klausman, 3 step cone, D.B.G., Q.C.G.
 1—18" x 8' Walcott, 3 step cone, D.B.G., Q.C.G.
 1—14" x 6' American, 3 step cone, S.B.G., Q.C.G.

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 7" Rhodes, Precision, new Shaper
 16" Used Smith-Mills Shaper
 16" Used Kelley, B. G. Shaper
 No. 4 Brown and Sharpe, Plain Miller
 No. 24 Osterlein, Plain Miller
 No. 22 Garvin, Vertical Miller
 No. 2 M. U. Garvin, Universal, new Miller
 No. 1 Dow, Plain, new Miller
 No. 3 Burk Hand Miller
 No. 3 1/2 Fox Hand Miller
 6' Western Universal Radial Drill
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 Springfield 16", 18", 20" cone pulley and geared head Engine Lathes.

48" x 24" bed Tange Geared Head Lathe

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12" Pollard Bench Drills.
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 20", 22", 24", 27" Pollard Upright Drills.
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PLANERS

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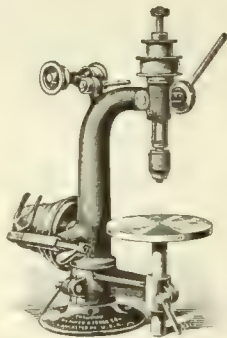
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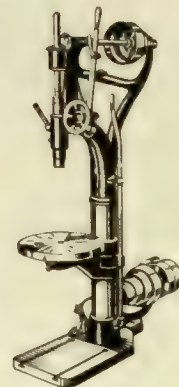
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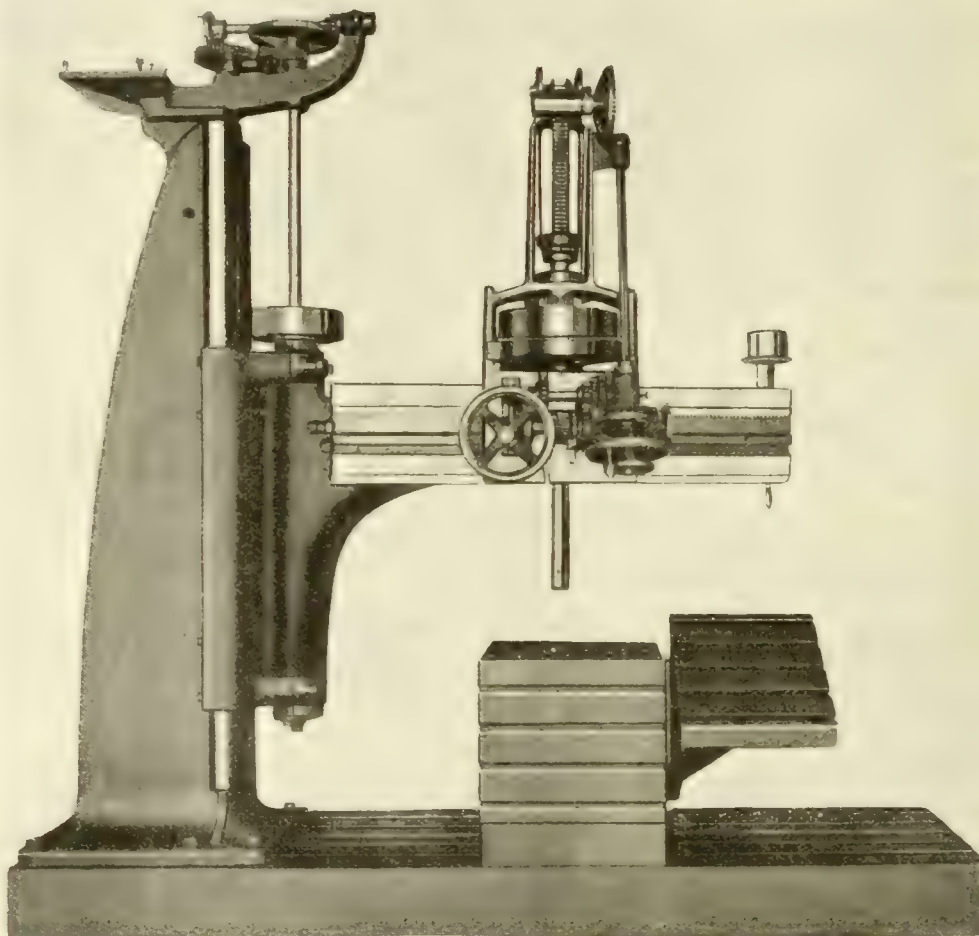


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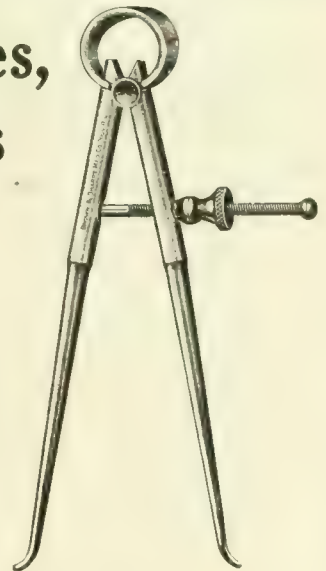
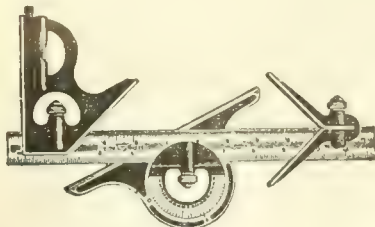
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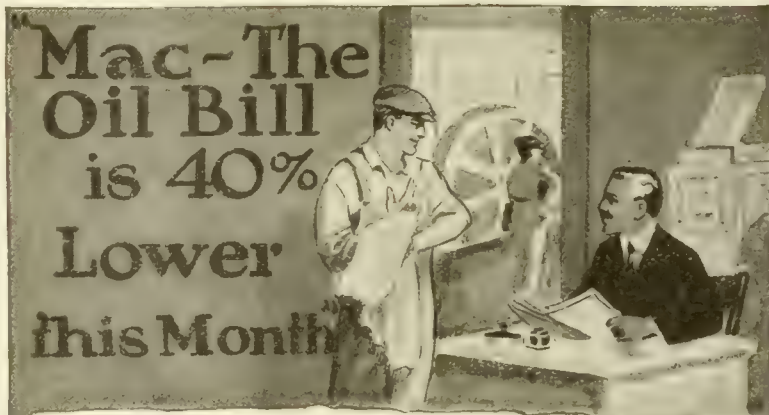
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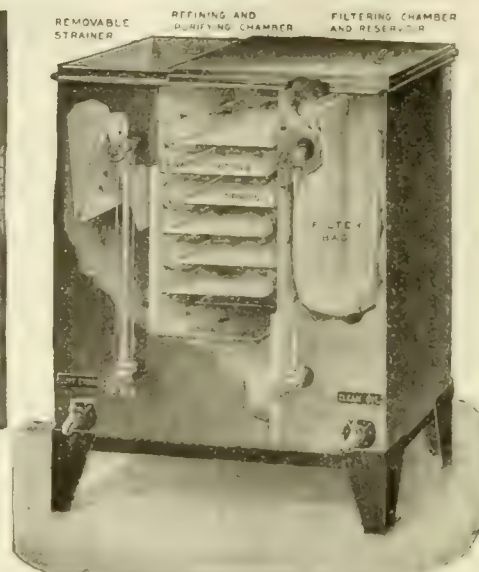
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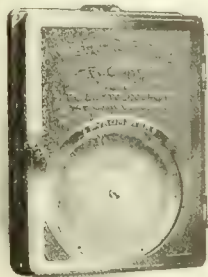
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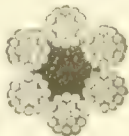
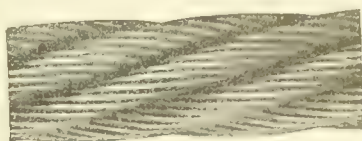
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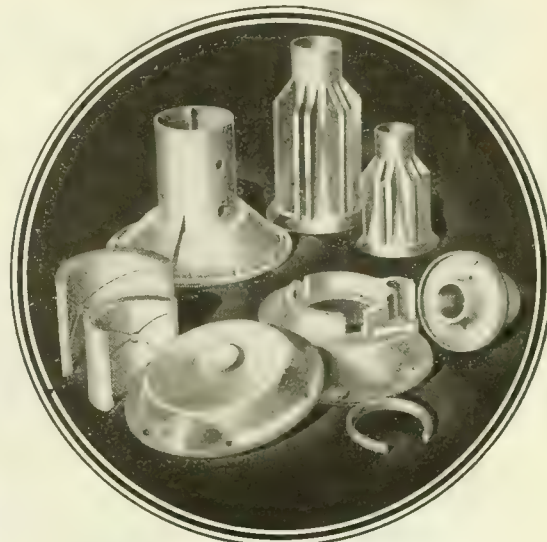
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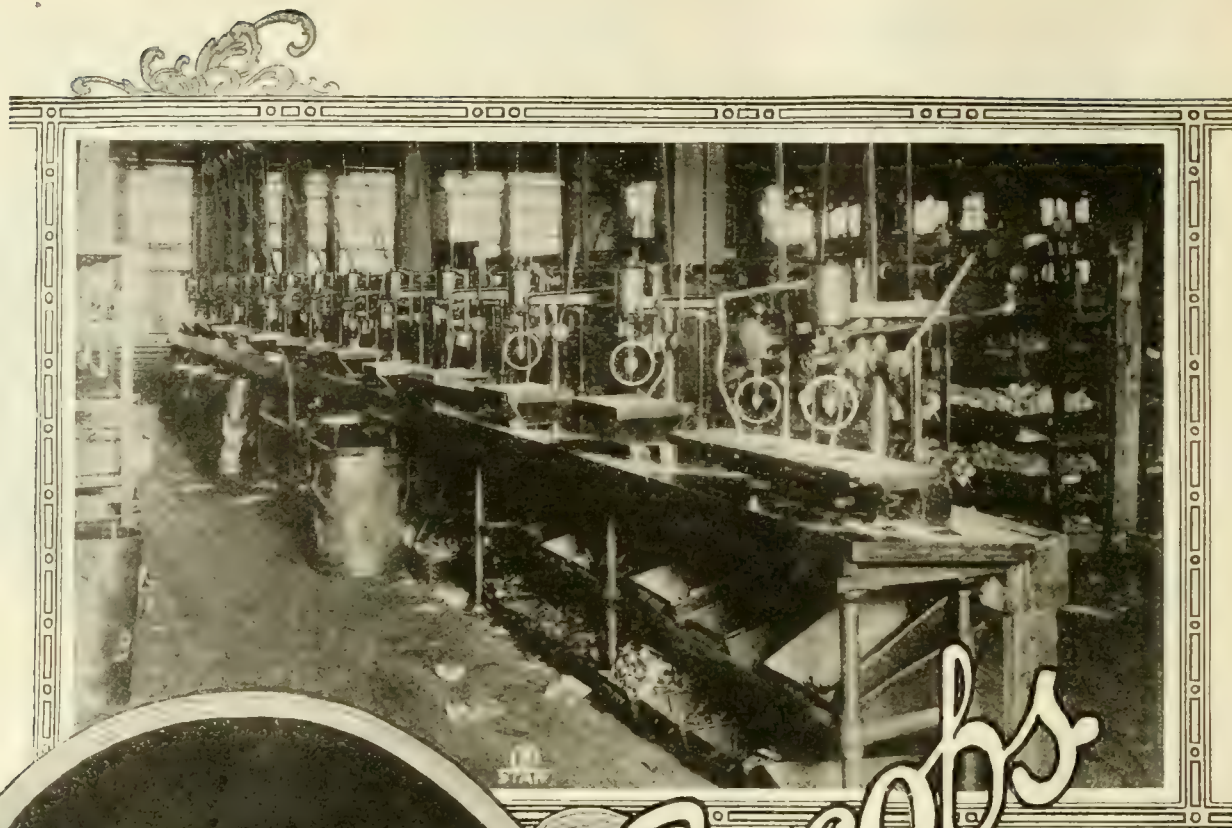
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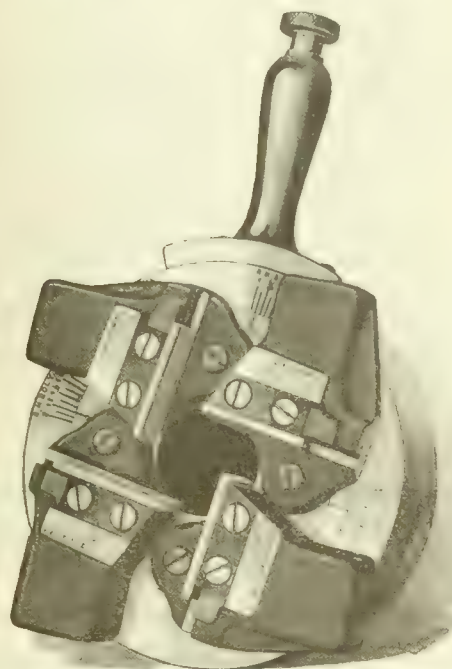


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7. No dirt or chips can enter inside of head.
8. Fewer parts enter into this head than any other make.
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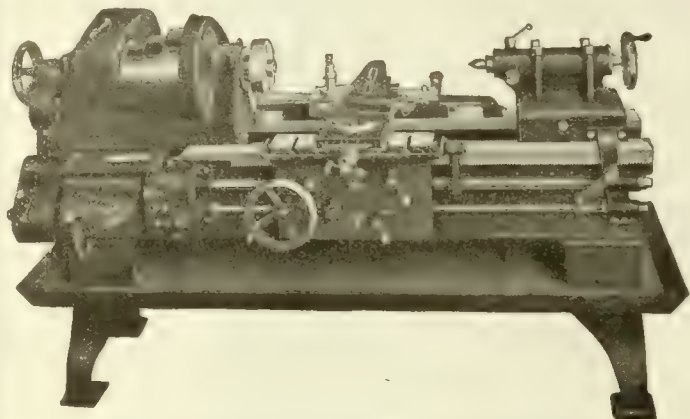
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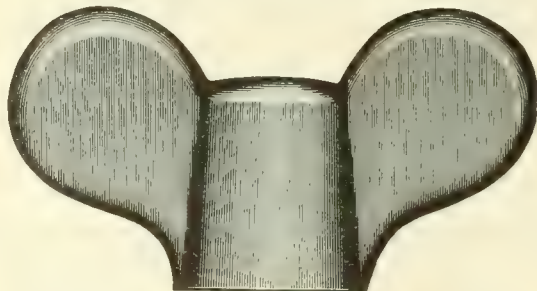
Convince yourself of these facts! Let us send you complete specifications of this superior lathe and the names of some of the larger concerns who are using "LEHMANN LATHES" for better results.

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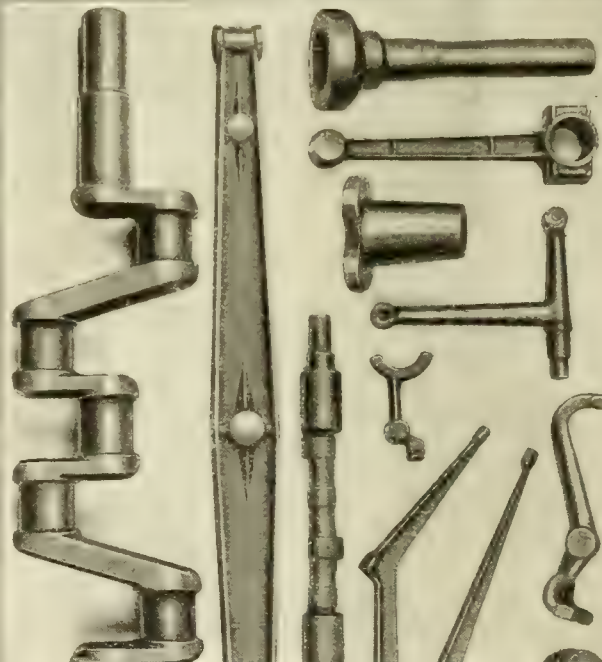


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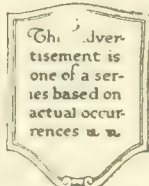
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$\frac{3}{4}$ lb. Oakite material cleans each lot of 100 pliers more satisfactorily than $1\frac{1}{2}$ lbs. chip soap previously used.

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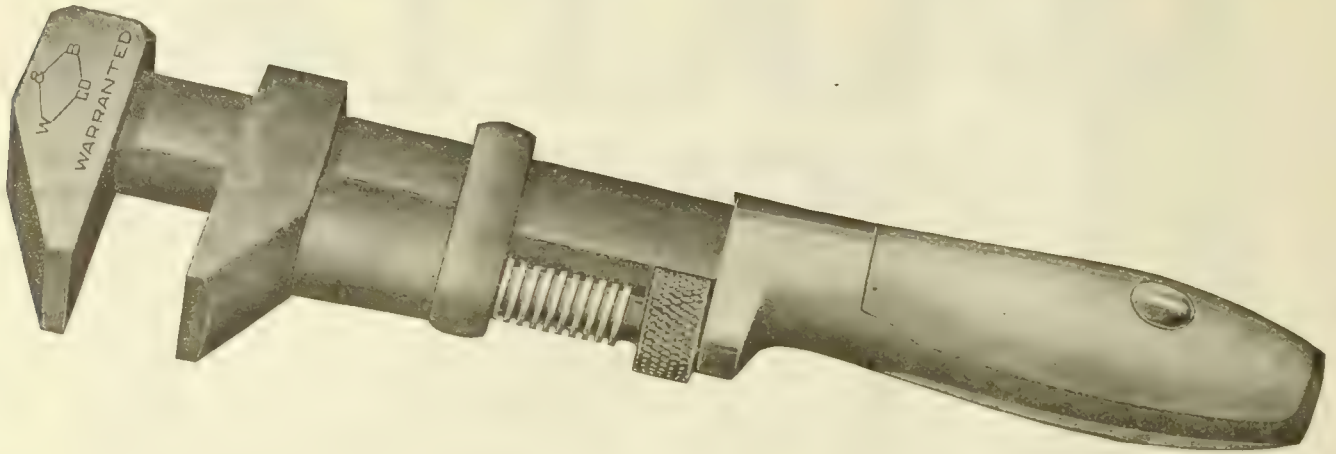


Results: Formerly impossible to avoid discoloration after plating around center bolt and nut in pliers. This weakness now eliminated. Production is speeded up by cut in cleaning time. Desirable saving in cleaning costs is effected.

May We Serve You, Too?

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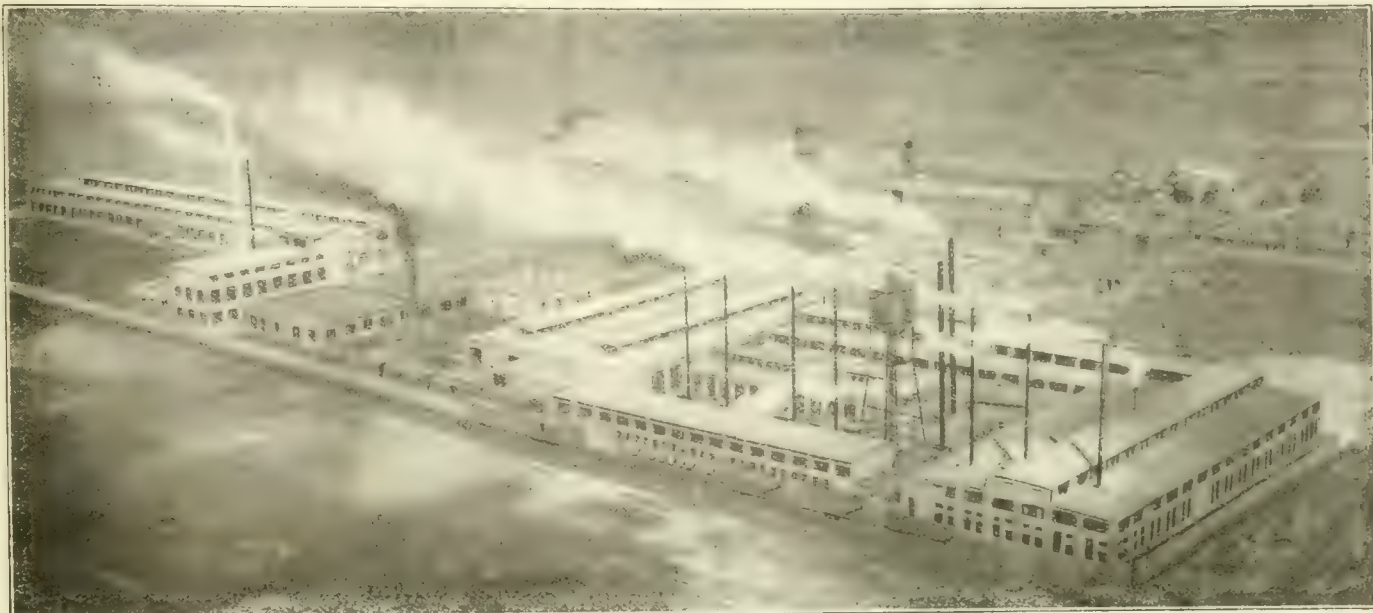
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The Miller for Small Work

A small machine takes up less space, requires less power, is easier to operate and is more accurate.

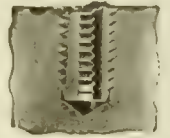
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Sixty-day trial offer proves the Walton Extractor pays for itself.

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For work requiring the utmost accuracy—

ROCKFORD MILLERS

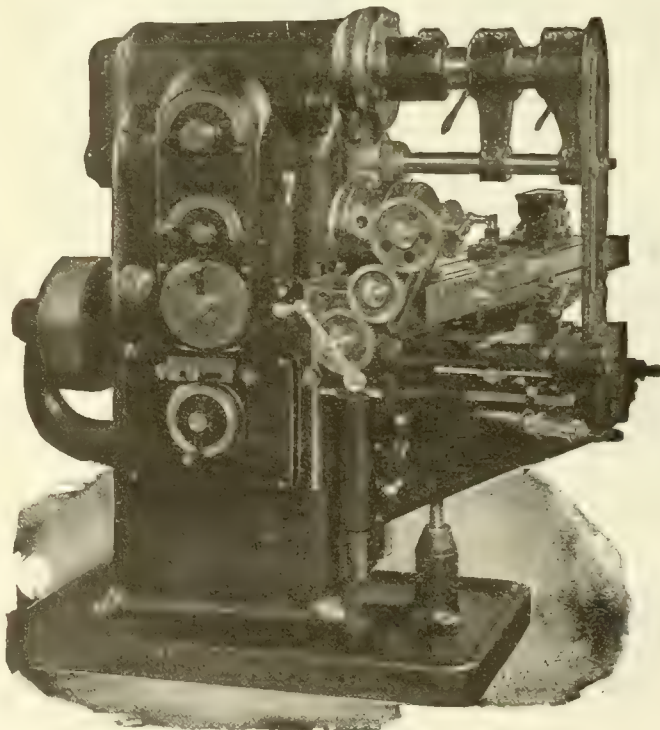
have established an enviable reputation among prominent manufacturers for accuracy, simplicity in construction and ease of operation. That they have been able to do this is credited to the great care exercised in their design, and the high-grade workmanship used in their construction.

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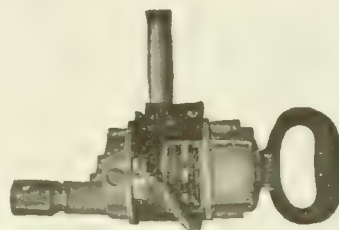
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They can be attached to any lamp socket.

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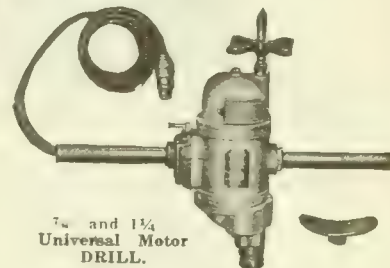
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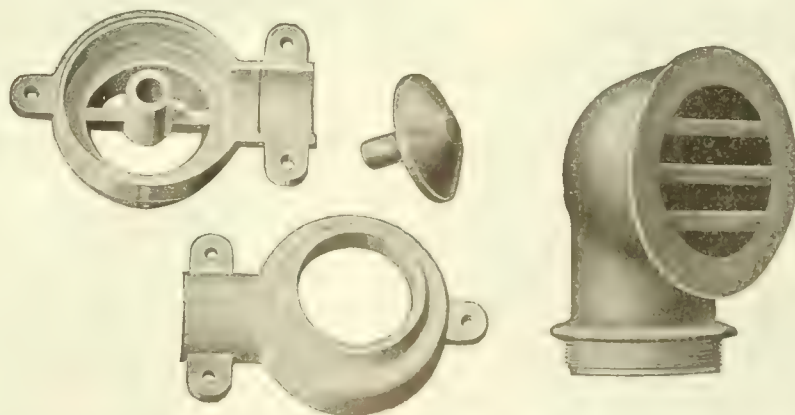
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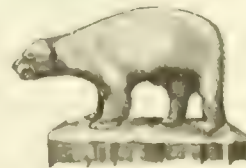
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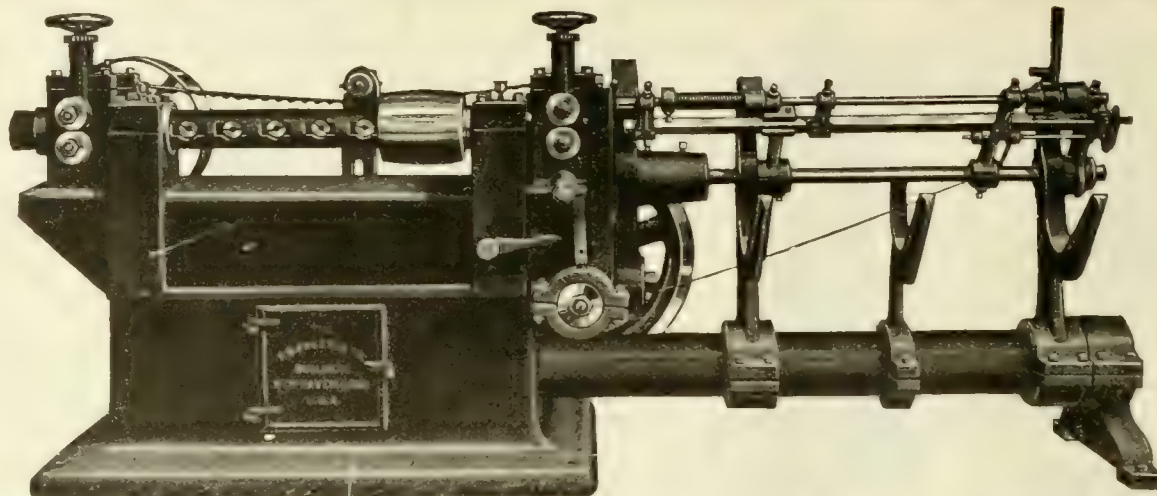
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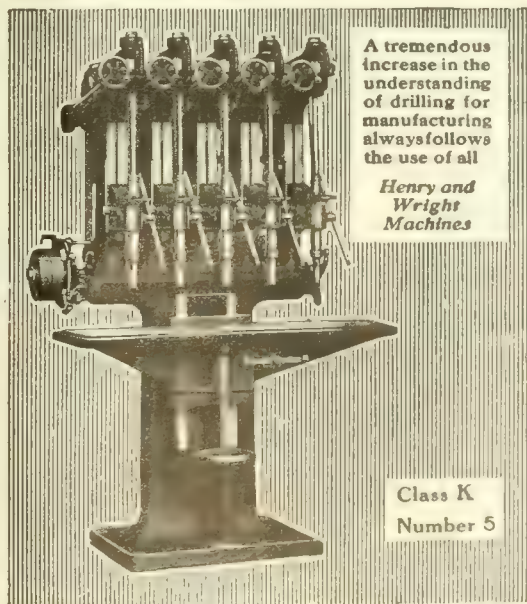
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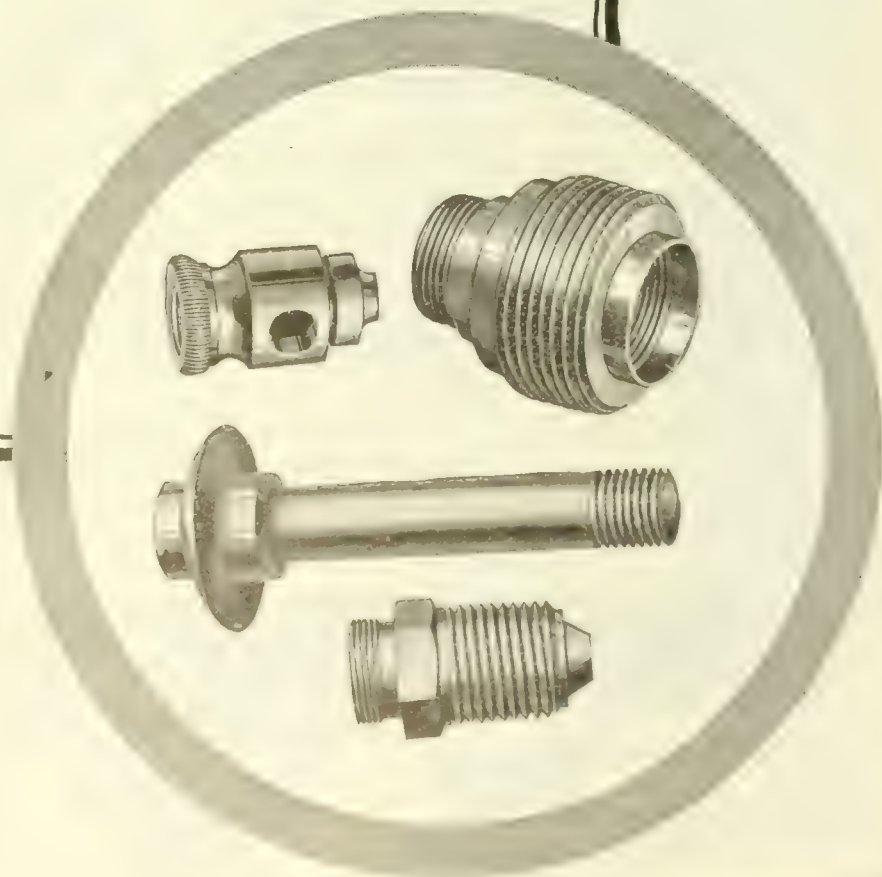
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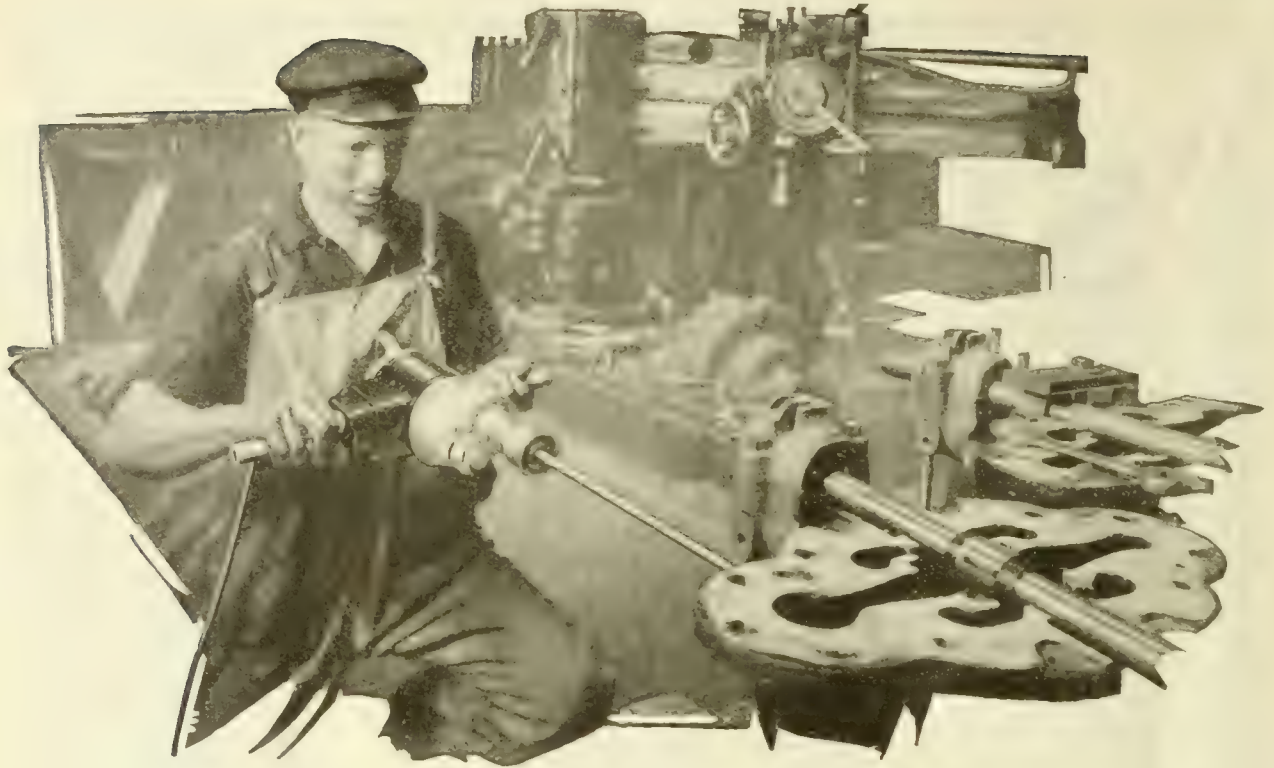
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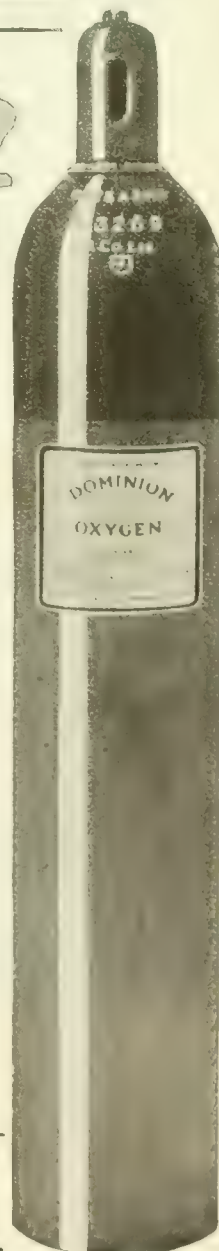
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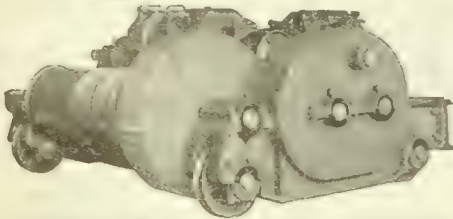
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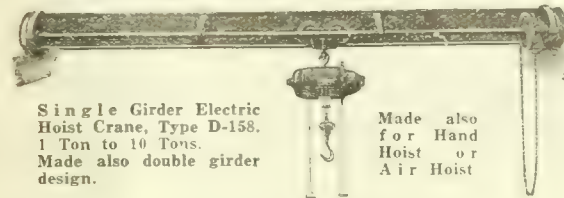


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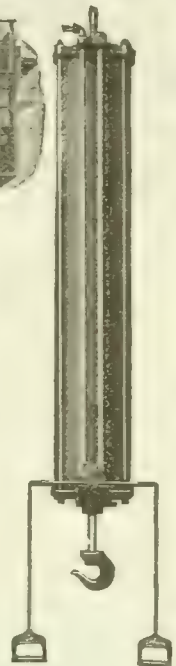
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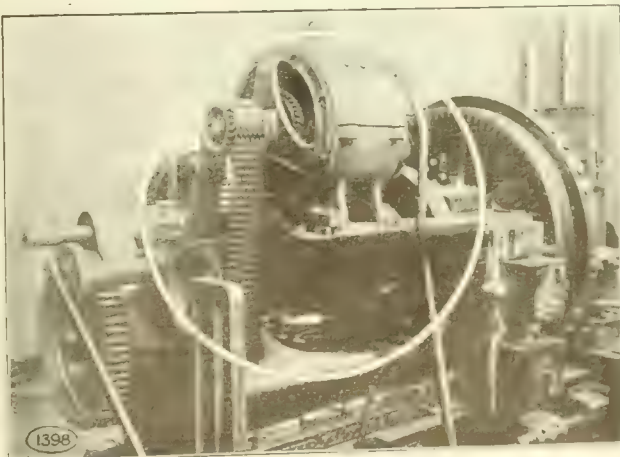
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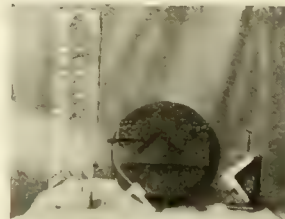
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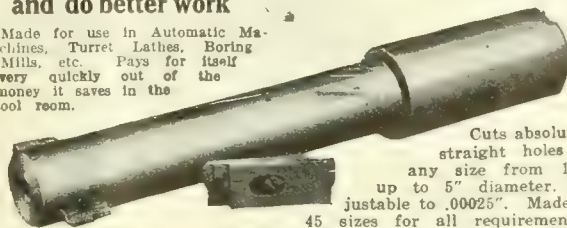
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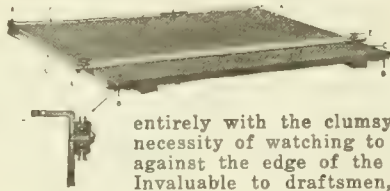
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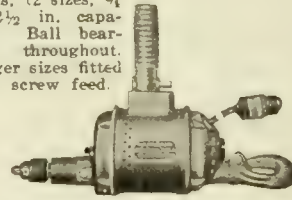
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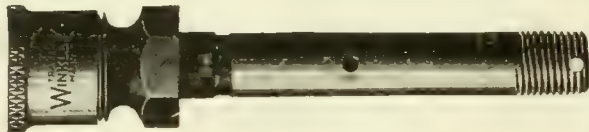
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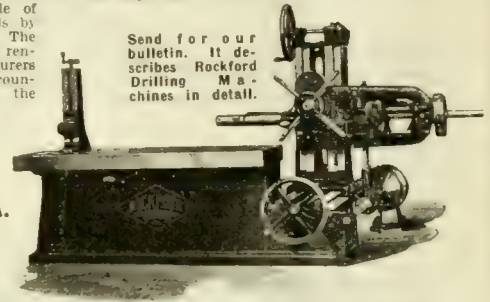
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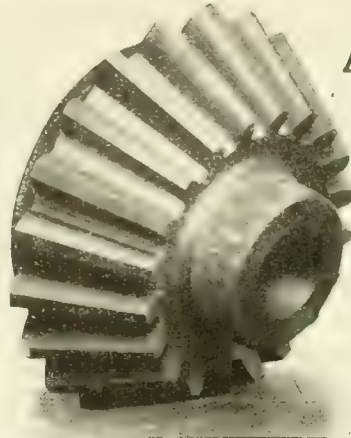
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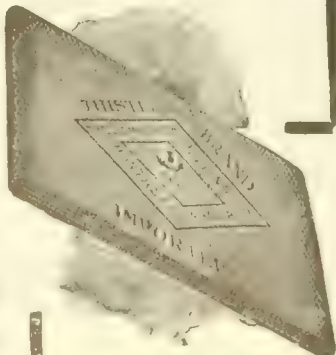
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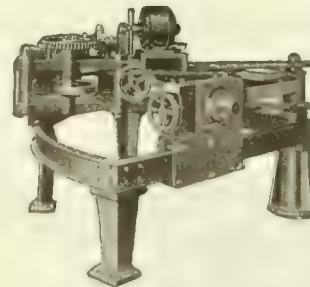
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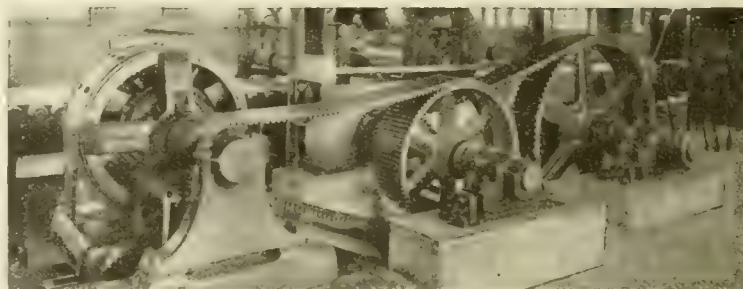
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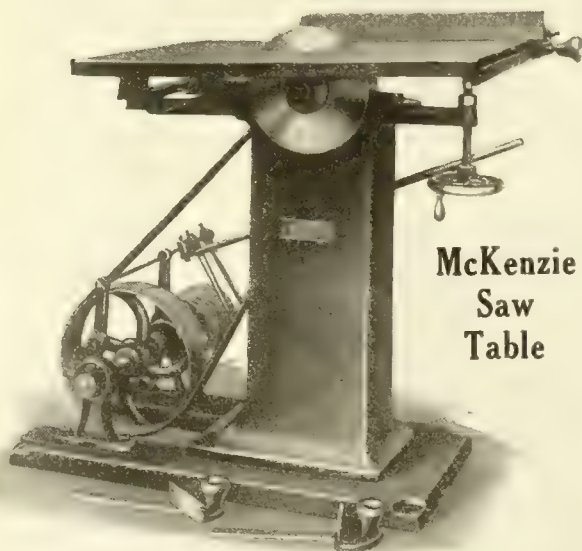
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Abrasive Discs

Carborundum Co., Niagara Falls, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oskey & Sons, Ltd., John London & E., Eng.
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Abrasive Materials

Carborundum Co., Niagara Falls, N.Y.
Dom Abrasive Wheel Co., Ltd., Minnec., Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oskey & Sons, Ltd., John, London, S.E., Eng.
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Acetylene, Dissolved

L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Dundas, Glasgow, Scot.

Air Lifts

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Air Purifiers and Coolers

Sturtevant Co., B. F., Boston, Mass.

Analyses, Chemical

Toronto Testing Laboratory, Toronto, Ont.

Anvils

Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Columbia Hove. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Arbors

Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempthorpe Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car

Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal

Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Balls, Brass, Bronze and Steel

Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling

Baird Machine Co., Bridgeport, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring

Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable

Underwood Corp. H. B., Philadelphia, Pa.

Bars, Bronze Cored

Moore & Son, Thos., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Bars, Steel

Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hillingsworth Steel Co., John, New York City, N.Y.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Wilkinson & Kompass, Hamilton, Ont.

Bearings, Ball

Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze

Tallman Brass & Metal Co., Hamilton, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast

Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal

Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Roller

Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement

Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Clamps

Graton & Knight Mfg. Co., Worcester, Mass.

Belt Dressings and Fillers

Alkenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'g Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners

Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Link-Belt Co., Grand Rapids, Mich.
Federal Eng'g Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Lacing

Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'g Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing Machines

Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'g Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Tools

Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain

Can. Link-Belt Co., Toronto, Ont.
James & Glesson, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric

Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dundas, Ont.
Dunlop Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'g Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather

Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Federal Eng'g Co., Ltd., Toronto, Ont.
Goudreau J. L. & Co., Danville, Que.
Graton & Knight Mfg. Co., Worcester, Mass.

McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber

Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive

Carborundum Co., Niagara Falls, N.Y.
Federal Eng'g Co., Ltd., Toronto, Ont.
Oskey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards

Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work

Alkenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore

MacKinnon Steel Co., Sherbrooke, Que.

Blocks

Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

Alkenhead Hardware Ltd., Toronto, Ont.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die

Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hillingsworth Steel Co., John, New York City, N.Y.

Blocks, Pillow

Can. Link-Belt Co., Toronto, Ont.

Blowers

Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic

National Acme Co., Cleveland, Ohio.

Bolts and Nuts

London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

Bolt Threading Die Heads

Landis Machine Co., Inc., Waynesboro, Pa.

Boosters

Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.
Universal Boring Machine Co., Hudson, Mass.

Boring, Drilling and Milling Mach., Vertical

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads

Alkenhead Hardware Ltd., Toronto, Ont.

Boring Tools

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)

Volta Mfg. Co., Welland, Ont.

Brass

Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Bricks, Fire

Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges

Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines

Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mch. Co., Toronto, Ont.

Bronze

Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkevillville, Ont.

Bronze, Phosphor

British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted

Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)

Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Buildozers

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.

Burners, Oil and Gas

Can. Hawk Burner Co., Port Hope, Ont.
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings

Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Calipers

Brown & Sharpe Mfg. Co., Providence, R.I.
Gould & Pratt Co., Greenfield, Mass.
Starrett Co., Lowell, Mass.

Cams

Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery)

Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Cars, Ore

MacKinnon Steel Co., Sherbrooke, Que.

Castings, Aluminum

Canada Electric Castings Co., Ltd., Orillia, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Electric Steel & Engineering Co., Welland, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Brass and Bronze

Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
 Canada Electric Castings Co., Ltd., Orillia
 Can. Hanson & Van Winkle Co., Toronto, Ont.
 Canada Metal Co., Ltd., Toronto, Ont.
 Can. Driver-Harris Co., Walkerville, Ont.
 Electric Steel & Engineering Co., Welland, Ont.
 International Machinery & Supply Co., Montreal, Que.
 Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Copper

Can. Hanson & Van Winkle Co., Toronto, Ont.
 Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Marine

Can. Steel Foundries, Montreal, Que.

Castings, Die Molded

Electric Steel & Engineering Co., Welland, Ont.
 Fisher Motor Co., Ltd., Orillia, Ont.
 Franklin Die-Casting Corp., Syracuse, N.Y.
 Kato Foundry Co., Galt, Ont.
 Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy

Can. Steel Foundries, Montreal, Que.

Castings, Iron

Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
 Bernard Industrial Co., A., Forterville, Que.
 Bilton Machine Co., Bridgeport, Conn.
 Brown, Boggs & Co., Ltd., Hamilton, Ont.
 Can. Hanson & Van Winkle Co., Toronto, Ont.
 Canada Electric Castings Co., Ltd., Orillia
 Electric Steel & Engineering Co., Welland, Ont.
 Fleck Ltd., Alexander, Ottawa, Ont.
 Hanna & Co., M. A., Cleveland, Ohio
 Hepburn Ltd., John T., Toronto, Ont.
 Katie Foundry Co., Galt, Ont.
 Kennedy & Sons, Wm., Owen Sound, Ont.
 McDougall Co., Ltd., R., Galt, Ont.
 Victoria Foundry Co., Ltd., Ottawa, Ont.
 Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Castings, Hyd. Press

Can. Steel Foundries, Montreal, Que.

Castings, Monel Metal

Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze

Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome

Can. Driver-Harris Co., Walkerville, Ont.
 Electric Steel & Engineering Co., Welland, Ont.
 Hull Iron & Steel Foundries, Hull, Que.
 Katie Foundry Co., Galt, Ont.
 Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Castings, Nickel

Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Semi-Steel

Davidson Mfg. Co., Thos., Montreal, Que.
 Electric Steel & Engineering Co., Welland, Ont.
 Hull Iron & Steel Foundries, Hull, Que.
 Katie Foundry Co., Galt, Ont.
 Manitoba Steel Foundries, Ltd., Winnipeg, Man.

Castings, Steel

Can. Steel Foundries, Montreal, Que.
 Kennedy & Sons, Wm., Owen Sound, Ont.
 Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron

Smooth Mfg. Co., Jersey City, N.J.

Centering Machines

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Garlock Walker Mch. Co., Toronto, Ont.

Chains (See Sprockets and Chains)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
 Morse Chain Co., Ithaca, N.Y.
 Philadelphia Gear Works, Philadelphia, Pa.
 Renold (Hans) of Canada, Ltd., Montreal, Que.
 Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving

Can. Link-Belt Co., Toronto, Ont.
 Greenfield Tap & Die Corp., Galt, Ont.
 Jones & Glasco, Montreal, Que.
 Morse Chain Co., Ithaca, N.Y.
 Renold (Hans) of Canada, Ltd., Montreal, Que.
 Wright Mfg. Co., Lisbon, Ohio.

Chasers

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Jones & Lamson Machine Co., Springfield, Vt.
 Landis Machine Co., Inc., Waynesboro, Pa.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists

Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines

Acme Machine Tool Co., Cincinnati, Ohio
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Jones & Lamson Machine Co., Springfield, Vermont
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
 Stebbins Turbine Machine Co., Madison, Wis.
 Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill

Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap

Alkenhead Hardware Ltd., Toronto, Ont.
 Canadian SKF Co., Toronto, Ont.
 Cushman Chuck Co., Hartford, Conn.
 Dom. Steel Products Co., Brantford, Ont.
 Goodell & Pratt Co., Greenfield, Mass.
 Morrow Sewer & Nut Co., Ltd., John, Ingersoll, Ont.
 Morse, Tracy, Hall & Machine Co., New Bedford, Mass.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
 Skinner Chuck Co., New Britain, Conn.
 Union Mfg. Co., New Britain, Conn.
 Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathes

Alkenhead Hardware Ltd., Toronto, Ont.
 Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Cushman Chuck Co., Hartford, Conn.
 Dom. Steel Products Co., Brantford, Ont.
 Foss Machinery & Supply Co., Geo. F., Montreal, Que.
 Geometric Tool Co., New Haven, Conn.
 Gisholt Machine Co., Madison, Wis.
 Ker & Goodwin Machine Co., Brantford, Ont.
 Petrie, Ltd., H. W., Toronto, Ont.
 Skinner Chuck Co., New Britain, Conn.
 Union Mfg. Co., New Britain, Conn.
 Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Cushman Chuck Co., Hartford, Conn.
 Skinner Chuck Co., New Britain, Conn.
 Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Gisholt Machine Co., Madison, Wis.
 Skinner Chuck Co., New Britain, Conn.
 Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'

Columbia Helve Division, Cleveland, O.
 Dickow, Fred C., Chicago, Ill.
 Starratt Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General

Quincy Chemical Co., New York, N.Y.

Clocks, Time

Gisholt Machine Co., Madison, Wis.
 International Business Machines Co., Toronto, Ont.

Clutches, Friction

Bernard Industrial Co., A., Forterville, Que.
 Can. Link-Belt Co., Toronto, Ont.
 Ford-Smith Machine Co., Hamilton, Ont.
 Johnson Machine Co., Carlyle, Manchester, Conn.
 Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
 Can. Link-Belt Co., Toronto, Ont.
 Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems

Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set

Canada Foundries & Forgings Co., Welland, Ont.
 Can. Link-Belt Co., Toronto, Ont.

Collets

Ackworth, Ltd., John, Birmingham, Eng.
 Butterfield & Co., Inc., Rock Island, Que.
 Canada Machinery Corp., Galt, Ont.
 Hendey Machine Co., Torrington, Conn.
 Kearney & Trecker Co., Milwaukee, Wis.
 Petrie, Ltd., H. W., Toronto, Ont.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering

Catacrat Refining Co., Toronto, Ont.

Compounds, Cleaning

Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
 Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting

Atkins & Co., Inc., E. C., Indianapolis, I.
 Catacrat Refining Co., Toronto, Ont.
 Oakley Chemical Co., New York, N.Y.

Compressors, Air

Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
 Garlock-Walker Mch. Co., Toronto, Ont.
 Holden Co., Ltd., Montreal, Que.
 Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction

Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps

Canada Foundries & Forgings Co., Welland, Ont.

Contract Work

Ford-Smith Machine Co., Hamilton, Ont.
 Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)

Jones & Glasco, Montreal, Que.
 Main Belting Co. of Can., Montreal, Que.
 Mathews Gravity Carrier Co., Port Hope, Ont.

Copper

Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars

Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins

Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores

Cleveland Twist Drill Co., Cleveland, O.
 Eclipse Counterbore Co., Ltd., Walkerville, Ont.
 Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution

Alkenhead Hardware Ltd., Toronto, Ont.
 Starratt Co., L. S., Athol, Mass.

Countershafts

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Canada Foundries & Forgings Co., Welland, Ont.

Ford-Smith Machine Co., Hamilton, Ont.
 Johnson Machine Co., Carlyle, Manchester, Conn.

Kearney & Trecker Co., Milwaukee, Wis.
 McDougall Co., Ltd., R., Galt, Ont.

Countersinks

Butterfield & Co., Inc., Rock Island, Que.
 Eclipse Counterbore Co., Ltd., Walkerville, Ont.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive

Can. Steel Foundries, Montreal, Que.

Couplings, Flexible

Relco Co., Ltd., Montreal, Que.

Couplings, Rigid

Bernard Industrial Co., A., Forterville, Que.

Couplings, Shaft

Bilton Machine Co., Bridgeport, Conn.
 Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Can. Link-Belt Co., Toronto, Ont.
 Dominion Bridge Co., Ltd., Lachine, Que.
 Hepburn Ltd., John T., Toronto, Ont.
 Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
 Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)

Dominion Bridge Co., Ltd., Lachine, Que.
 Hepburn Ltd., John T., Toronto, Ont.
 Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
 Northern Crane Works, Walkerville, Ont.
 Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive

Can. Link-Belt Co., Toronto, Ont.
 Holden Co., Ltd., Montreal, Que.

Cranes, Traveling

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Can. Link-Belt Co., Toronto, Ont.
 Dominion Bridge Co., Ltd., Lachine, Que.
 Hepburn Ltd., John T., Toronto, Ont.
 Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
 Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines

Garlock-Walker Mch. Co., Toronto, Ont.
 Herbert Ltd., Alfred, Toronto, Ont.
 Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue

Holden Co., Ltd., Montreal, Que.

Cutters, Gear

Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Butterfield & Co., Inc., Rock Island, Que.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
 Atkins & Co., Inc., E. C., Indianapolis, I.
 Bilton Machine Co., Bridgeport, Conn.
 Butterfield & Co., Inc., Rock Island, Que.
 Eclipse Counterbore Co., Ltd., Walkerville, Ont.
 Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
 Kearney & Trecker Co., Milwaukee, Wis.
 Madison Mfg. Co., Muskegon, Mich.

Pilot Steel & Tool Co., Montreal, Que.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling

Armstrong Whitworth of Canada, Ltd., Montreal, Canada
 Bilton Machine Co., Bridgeport, Conn.
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Butterfield & Co., Inc., Rock Island, Que.
 Cleveland Milling Machine Co., Cleveland, Ohio
 Elliott & Whitehall Tool Co., Galt, Ont.
 Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
 Kearney & Trecker Co., Milwaukee, Wis.
 Morse Twist Drill & Machine Co., New Bedford, Mass.
 Pilot Steel & Tool Co., Montreal, Que.
 Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Cutters, Stay Bolt

Acme Machinery Co., Cleveland, Ohio.
 Landis Machine Co., Inc., Waynesboro, Pa.
 Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread

Butterfield & Co., Inc., Rock Island, Que.
 Greenfield Tap & Die Corp., Galt, Ont.
 Jones & Lamson Machine Co., Springfield, Vt.
 Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines

Bertram & Son Co., Ltd., The John, Dundas, Ont.
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Garlock-Walker Mch. Co., Toronto, Ont.
 Greenfield Tap & Die Corp., Galt, Ont.
 Petrie, Ltd., H. W., Toronto, Ont.
 Starratt Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Landis Machine Co., Inc., Waynesboro, Pa.
 McDougall Co., Ltd., R., Galt, Ont.
 Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools

Armstrong Whitworth of Canada, Ltd., Montreal, Canada
 Armstrong Bros. Tool Co., Chicago, Ill.
 Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)

Harvey & Co., Ltd., Toronto, Can.
 Catacrat Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene

Carter Welding Co., Toronto, Ont.
 Holden Co., Ltd., Montreal, Que.
 Perdue, W. B., San Francisco, Calif.
 Prest-O-Lite Co. of Can., Toronto, Ont.
 Turner Brass Works, Sycamore, Ill.
 Union Carbide Co. of Can., Welland, Ont.

Dealers, Machinery (See Searchlight Section)

Ford-Smith Machine Co., Hamilton, Ont.
 Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough

Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz

Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools

Alkenhead Hardware Ltd., Toronto, Ont.
 Can. Desmond-Stephan Co., Hamilton, Ont.
 Ford-Smith Machine Co., Hamilton, Ont.
 Wheel Trueling Tool Co., Detroit, Mich.

Diamond Crossings

Can. Steel Foundries, Montreal, Que.

Die-Castings

Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading

Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic

Jones & Lamson Machine Co., Springfield, Vt.
 Walcott Lathe Co., Jackson, Mich.

Die Sinkers

Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting

Ackworth, Ltd., John, Birmingham, Eng.
 Butterfield & Co., Inc., Rock Island, Que.
 Greenfield Tap & Die Corp., Galt, Ont.
 Jardine & Co., A. B., Hespeler, Ont.
 Jones & Lamson Machine Co., Springfield, Vt.
 Landis Machine Co., Inc., Waynesboro, Pa.
 Murchey Machine & Tool Co., Detroit, Mich.
 National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
 Brown, Boggs & Co., Ltd., Hamilton, Ont.
 Fisher Motor Co., Ltd., Orillia, Ont.
 Ford-Smith Machine Co., Hamilton, Ont.
 Toledo Machine & Tool Co., Toledo, Ohio.

Dies, Forging

Armstrong Whitworth of Canada, Ltd., Montreal, Canada
 Brown, Boggs & Co., Ltd., Hamilton, Ont.
 Canada Foundries & Forgings Co., Welland, Ont.
 Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
 Kimber & Hillier Mfg. Co., St. Catharines, Ont.

BUYERS' DIRECTORY

Dies, Hammer
Kemp & H. H. H. S. Co., Ont.

Dies, Self-Opening, Adjustable

General Tool Co., New Haven, Conn.
Hobart Ltd., Amherst, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Lathrop Machine Co., Weynesboro, Pa.
Machinists Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Victor Tool Co., Weynesboro, Pa.

Dies, Threading-Opening

Jardine & Co., A. B. Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Lathrop Machine Co., Weynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Morse Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement

Ritchey Supply Co., Toronto, Ont.
Windsor Abrasives Co., Chicago, Ill.

Dividing Heads

Ackworth, Ltd., John, Birmingham, Eng.
Dunham, Fred C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendy Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine

Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables

Dunham, Fred C., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials

American Lead Pencil Co., New York City, N.Y.
Dunham, Fred C., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel

Carborundum Co., Niagara Falls, N.Y.
Don, Abrasive Wheel Co., Ltd., Mimico, Ont.

Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.

Drill Holders

Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods

Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders

Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads

Henry & Wright Mfg. Co., Hartford, Conn.
Hoefler Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic

Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench

Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Goodell & Pratt Co., Greenfield, Mass.
Henry & Wright Mfg. Co., Hartford, Conn.
High Speed Hammer Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.

Foss Machinery & Supply Co., Geo. F., Montreal, Que.

Garlock-Walker Mch. Co., Toronto, Ont.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mch. Co., Toronto, Ont.
Hoefler Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty

Armstrong-Whitworth Co. of Can., Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle

Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefler Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Carlock-Walker Mch. Co., Toronto, Ont.

Holden Co., Ltd., Montreal, Que.

Independent Pneumatic Tool, Chicago, Ill.

Jardine & Co., A. B., Hespeler, Ont.

Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Portable

Haskins Co., R. C., Chicago, Ill.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mch. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ransom & Son, Jas. T., Chicago, Ill.
Toomey Inc., Frank, Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive

Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
High Speed Hammer Co., Rochester, N.Y.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret

Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical

Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Canada Machinery Corp., Galt, Ont.

Can. Blower & Forge Co., Ltd., Kitchener.

Garlock-Walker Mch. Co., Toronto, Ont.

Herbert Ltd., Alfred, Toronto, Ont.

Hoefler Mfg. Co., Freeport, Ill.

Hoosier Drilling Mach. Co., Goshen, Ind.

McDougall Co., Ltd., R., Galt, Ont.

Petrie, Ltd., H. W., Toronto, Ont.

Rockford Drilling Machine Co., Rockford, Ill.

Rockford Lathe & Drill Co., Rockford, Ill.

Perfect Machine Co., Ltd., Galt, Ont.

Terry & Co., John C., Birmingham, Eng.

Windsor, Ont.

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, High Speed Twist

Armstrong-Whitworth Co. of Can., Ltd., Montreal, Que.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mch. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
International Machinery & Supply Co., Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Pilot Steel & Tool Co., Montreal, Que.

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Sheffield Engineering Supplies, Ltd., Montreal, Que.

Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Taylor Tool Co., J. A. M., Toronto, Ont.

Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener.

Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments

Bristol Co., Waterbury, Conn.

Northern Electric Co., Montreal, Que.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.

Diamond State Fibre Co., Toronto, Ont.

Northern Electric Co., Montreal, Que.

U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Jones & Glasgow, Montreal, Que.

Lyman Tube & Supply Co., Montreal, Que.

Main Belting Co. of Can., Montreal, Que.

Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Cloth

Vausau Abrasives Co., Chicago, Ill.

Emery Wheels (See Grinding Wheels)

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Carborundum Co., Niagara Falls, N.Y.
Don Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
International Machinery & Supply Co., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical

For Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube

Garlock-Walker Mch. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Jardine & Co., A. B., Hespeler, Ont.

Petrie, Ltd., H. W., Toronto, Ont.

Eye-glasses, Safety (See Goggles)

Prest-O-Lite Co. of Can., Toronto, Ont.

Willson Goggles, Inc., Reading, Pa.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener.

Northern Electric Co., Montreal, Que.

Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.

Petrie, Ltd., H. W., Toronto, Ont.

Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can. Blower & Forge Co., Ltd., Kitchener.

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Petrie, Ltd., H. W., Toronto, Ont.

Sturtevant Co., B. F., Boston, Mass.

Fibre

Diamond State Fibre Co., Toronto, Ont.

Northern Electric Co., Montreal, Que.

File Handles

Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps

Atkins & Co., Inc., E. C., Indianapolis, I.

Foss Machinery & Supply Co., Geo. F., Montreal, Que.

Ingersoll File Co., Ltd., Ingersoll, Ont.

International Machinery & Supply Co., Montreal, Que.

Nicholson File Co., Port Hope, Ont.

Simonds Canada Saw Co., Montreal, Que.

Filing Machines

Garlock-Walker Mch. Co., Toronto, Ont.

Filler, Iron (See Cements, Iron)

Smith Mfg. Co., Jersey City, N.J.

Fire Extinguishers

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe

International Malleable Iron Co., Guelph, Ont.

Flexible Shafts

Aikenhead Hardware Ltd., Toronto, Ont.

Haskins Co., R. G., Chicago, Ill.

Flux, Galvanizing

British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding

L'Air Liquide Society, Toronto, Ont.

Forging Machinery

Acme Machinery Co., Cleveland, Ohio.

Bertram & Son Co., Ltd., The John, Dundas, Ont.

Brown, Boggs & Co., Ltd., Hamilton, Ont.

Canada Machinery Corp., Galt, Ont.

Garlock-Walker Mch. Co., Toronto, Ont.

National Machinery Co., Tiffin, Ohio.

Stewart & Co., Duncan, Glasgow, Scot.

Forgings, Drop

Canada Foundries & Forgings Co., W. land, Ont.

Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.

Canada Foundries & Forgings Co., W. land, Ont.

Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dominion Bridge Co., Ltd., Lachine, Que.

Dom. Foundries & Steel, Hamilton, Ont.

Hepburn Ltd., John T., Toronto, Ont.

N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Ford-Smith Machine Co., Hamilton, Ont.

Holden Co., Ltd., Montreal, Que.

McDougall Co., Ltd., R., Galt, Ont.

Petrie, Ltd., H. W., Toronto, Ont.

Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.

Rice Lewis & Son, Ltd., Toronto, Ont.

Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid

Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System

General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric

Electric Furnace Construction Co., Philadelphia, Pa.

General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Heat Treating Coal

General Combustion Co. of Can., Ltd., Montreal, Que.

Mechanical Engineering Co., Three Rivers, Que.

Rockwell Co., W. S., New York City

Furnaces, Heat Treating Oil and Gas

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.

Bellevue Industrial Furnace Co., Detroit, Can.

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

General Combustion Co. of Can., Ltd., Montreal, Que.

Mechanical Engineering Co., Three Rivers, Que.

Rockwell Co., W. S., New York City

Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric

Electric Furnace Construction Co., Philadelphia, Pa.

Petrie, Ltd., H. W., Toronto, Ont.

BUYERS' DIRECTORY

Gages, Snap, Thread and Cylindrical
Ackworth, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd.,
Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Elliott & Whitehall Tool Co., Galt, O.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Thread
Ackworth, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Garnet, Emery and Flint Paper and Cloth
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd.,
Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd.,
Toronto, Ont.
Goodyear Tire & Rubber Co. of Can.,
Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gear Blanks
Canada Foundries & Forgings Co., Wel-
land, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd.,
Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Ontario.
Philadelphia Gear Works, Philadelphia,
Pa.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whitton Machine Co., D. E., New London,
Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto,
Ontario.

Gears, Cut
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glasco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Pa.
Renold (Hans) of Canada, Ltd., Mont-
real, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Wel-
land, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto,
Ont.
Philadelphia Gear Works, Philadelphia,
Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto,
Ontario.
Philadelphia Gear Works, Philadelphia,
Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal,
Quebec

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto,
Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.

Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Standard Optical Co., Geneva, N.Y.
Wilson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara
Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Goodell & Pratt Co., Greenfield, Mass.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Works,
Grand Rapids, Mich.
Morse Twist Drill & Machine Co., New
Bedford, Mass.

Grinding Machines, Bench
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.
Rockford Drilling Machine Co., Rockford,
Ill.
Roelofs Machine & Tool Co., Toronto,
Ont.

Grinding Machines, Bench
Waltham Grinding Wheel Co., Waltham,
Mass.

Grinding Machines, Bench
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A.,
Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Chaser
Jones & Lamson Machine Co., Spring-
field, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincin-
nati, Ohio.
Garlock-Walker Mch. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mch. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Manhattan Machine & Tool Works,
Grand Rapids, Mich.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield,
Vermont.

Grinding Machines, Die
Murphy Machine & Tool Co., Detroit,
Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.

Grinding Machines, Floor and Tool
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.
Wilkinson & Kompass, Hamilton, Ont.

Grinding Machines, Internal
Garlock-Walker Mch. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Manhattan Machine & Tool Works,
Grand Rapids, Mich.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.

Grinding Machines, Portable
Carborundum Co., Niagara Falls, N.Y.
Cincinnati Electrical Tool Co., Cincinnati,
Ohio.

Grinding Machines, Portable
Cleveland Pneumatic Tool Co., Toronto,
Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Haskins Co., R. G., Chicago, Ill.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wilkinson & Kompass, Hamilton, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mch. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wilkinson & Kompass, Hamilton, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.

Grinding Machines, Universal
Garlock-Walker Mch. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Machine Co., Greenfield, Mass.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Works,
Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New
Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofs Machine & Tool Co., Toronto,
Ont.
Waltham Grinding Wheel Co., Waltham,
Mass.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Carborundum Co., Niagara Falls, N.Y.
Dom. Abrasive Wheel Co., Ltd., Mimico,
Ont.
Ford-Smith Machine Co., Hamilton, Ont.
International Machinery & Supply Co.,
Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton,
Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworth, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mch. Co., Toronto, Ont.
Goodell & Pratt Co., Greenfield, Mass.
Lyman Tube & Supply Co., Montreal, Que.
McKenzie Machinery Co., Guelph, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto,
Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John,
Dundas, Ont.

Hammers, Drop
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Wel-
land, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.

Hammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto,
Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand
Haven, Mich.
Ryerson & Son, Jos. T., Chicago, Ill.

Hammers, Power
Bertram & Son Co., Ltd., The John,
Dundas, Ont.

Hammers, Power
Bradley & Son, Inc., C. C., Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.

Hammers, Riveting
Cleveland Pneumatic Tool Co., Toronto,
Ont.

Hammers, Riveting
Ryerson & Son, Jos. T., Chicago, Ill.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co.,
Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

**Hardening, Case-Hardening and Tem-
pering**
Hamilton Gear & Machine Co., Toronto,
Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong Whitworth Co. of Canada, Ltd.,
Montreal, Canada.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara
Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara
Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.

Hoists, Pneumatic
Curtis Pneumatic Machinery Co., St.
Louis, Mo.
Garlock-Walker Mch. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara
Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders, On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.

Holders, On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto,
Ont.

Holders, On, Pneumatic
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, All Kinds
Quaker City Rubber Co., Philadelphia, Pa.

Hose, Flexible
Gutta Percha & Rubber, Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd.,
Toronto, Ont.

Hose, Industrial
Goodyear Tire & Rubber Co. of Can.,
Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd.,
Montreal, Que.

Hose, Rubber
Can. Foamite Firefoam Co., Hamilton,
Ont.

Hose, Steam, Suction, Water
Quaker City Rubber Co., Philadelphia, Pa.

Hose, Steel
International Machinery & Supply Co.,
Montreal, Que.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester,
Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John,
Dundas, Ont.

Hydraulic Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Que.

Hydraulic Machinery
Garlock-Walker Mch. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Index Centers
Dickow, Fred. C., Machinery Co., Chi-
cago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Wel-
land, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd.,
Toronto, Ont.

Jacks, Hydraulic
International Machinery & Supply Co.,
Montreal, Que.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.

Jacks, Planer
Starrett Co., L. S., Athol, Mass.

Jigs and Fixtures (See Tool Work)
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co., Ltd., Montreal, Q.

BUYERS' DIRECTORY

Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd.,
Hamilton, Ont.

Rapid Tool & Machine Co., Lachine, Que.
Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Elliott & Whitehall Tool Co., Galt, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Morse Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.
Toomey Inc., Frank, Philadelphia, Pa.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Morse Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Lacing Leather
Clippert Belt Lacer Co., Grand Rapids,
Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Eng'g Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd.,
Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

**Lathe, Automatic and Semi-Auto-
matic**
Armstrong-Whitworth of Canada, Ltd.,
Vermont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Spring-
field, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathe, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Lathe, Boring
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

**Lathe, Chucking (See Lathe, Hor-
izontal Turret, and Lathe, Ver-
tical Turret)**
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield,
Vermont.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathe, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.
Garlock-Walker Mch. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Ministry of Munitions, London, Eng.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford,
Ill.
Roelofson Machine & Tool Co., Toronto,
Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A.,
Windsor, Ont.
Walker & Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

Lathe, Extension and Gap
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

**Lathe, Heavy Duty Projectile Bor-
ing**
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.

Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

Lathe, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Spring-
field, Vt.

McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford,
Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

**Lathe, Polishing (See Polishing and
Buffing Machines)**
Ford-Smith Machine Co., Hamilton, Ont.

Lathe, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Screw-Cutting
Jones & Lamson Machine Co., Spring-
field, Vt.

Lathe, Speed and Hand
Garlock-Walker Mch. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Lathe, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathe, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathe, Vertical Turret
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield,
Vermont.
Roelofson Machine & Tool Co., Toronto,
Ont.

Lathe, Wood Turning
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton,
Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton,
Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowler, S. F., & Co., Ltd., Toronto, Can.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd.,
Vermont.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Canada Foundries & Forgings Co., Wel-
land, Ont.

Can. Fairbanks-Morse Ltd., Montreal Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.
Goodell & Pratt Co., Greenfield, Mass.
Ker & Goodwin Machine Co., Brantford,
Ont.

Ministry of Munitions, London, Eng.
National Machine Tool Co., Racine, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford,
Ill.

Ryerson & Son, Jos. T., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A.,
Windsor, Ont.
Wheel Truening Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto,
Ont.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Metals, Alloy

British Smelting & Refining Co., Ltd.,
Montreal, Que.
Brown's Copper & Brass Rolling Mills,
Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd.,
Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd.,
Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd.,
Toronto, Ont.

Magcolla Metal Co., Montreal, Que.
Ministry of Munitions, London, Eng.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton,
Ontario.
Walker & Sons Metal Products, Ltd.,
Hiram, Walkerville, Ont.

Metalite Cloth
Ritchey Supply Co., Toronto, Ont.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincin-
nati, Ohio.

Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kemp Smith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincin-
nati, Ohio.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Garlock-Walker Mch. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford,
Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.
Rockford Milling Machine Co., Rockford,
Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincin-
nati, Ohio.

**Milling Machines, Horizontal and
Planer Type**
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal Q.
Cleveland Milling Machine Co., Cleveland,
Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford,
Ill.

Roelofson Machine & Tool Co., Toronto,
Ont.
Williams Machinery Co., A. R., Toronto,
Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincin-
nati, Ohio.
Cleveland Milling Machine Co., Cleveland,
Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F.,
Montreal, Que.

Garlock-Walker Mch. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kemp Smith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford,
Ill.
Terry & Co., John C., Birmingham, Eng.
Toomey Inc., Frank, Philadelphia, Pa.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd.,
Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd.,
Vermont.
Cincinnati Milling Machine Co., Cincin-
nati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mch. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kemp Smith Mfg. Co., Milwaukee, Wis.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford,
Ill.

Roelofson Machine & Tool Co., Toronto,
Ont.
Ryerson & Son, Jos. T., Chicago, Ill.
Toomey Inc., Frank, Philadelphia, Pa.
Williams Machinery & Supply Co., A. R.,
Montreal, Que.

Milling Machines, Vertical
Cincinnati Milling Machine Co., Cincin-
nati, Ohio.
Garlock-Walker Mch. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kemp Smith Mfg. Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford,
Ill.
Williams Machinery Co., A. R., Toronto,
Ont.

Monel Metal
International Nickel Co. of Can., Ltd.,
Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Garlock-Walker Mch. Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.
Williams Machinery Co., A. R., Toronto,
Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd.,
Montreal, Que.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd.,
Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd.,
Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills,
Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

**Nut Tappers (See Bolt and Nut Ma-
chinery)**
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John,
Dundas, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.

Oil Filtering and Storage Systems
Bowler, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowler, S. F., & Co., Ltd., Toronto, Can.

Oils
Canadian Oil Companies, Ltd., Toronto,
Ont.
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Stones
Carborundum Co., Niagara Falls, N.Y.

Oxygen
Carter Welding Co., Toronto, Ont.
Domilun Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd.,
Montreal, Que.

Graton & Knight Mfg. Co., Worcester,
Mass.
Guilford & Sons, Ltd., Halifax, N.S.
Gutta Percha & Rubber, Toronto, Ont.
International Machinery & Supply Co.,
Montreal, Que.

Packing, Rod and Steam
Quaker City Rubber Co., Philadelphia, Pa.

Packing, Steam
Can. Consolidated Rubber Co., Ltd.,
Montreal, Que.
Graton & Knight Mfg. Co., Worcester,
Mass.
Guilford & Sons, Ltd., Halifax, N.S.
Gutta Percha & Rubber, Toronto, Ont.
International Machinery & Supply Co.,
Montreal, Que.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

**Pattern-Shop Machinery (See Wood-
working Machinery)**
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wagon Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

BUYERS' DIRECTORY

Phosphor Tin
British Smelting & Refining Co. Ltd.
Montreal, Que.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines

American Pipe Bending Machine Co.,
Boston, Mass.
Underwood Corp., H. B., Philadelphia,
Pa.
Williams Machinery Co., A. R., Toronto,
Ont.

Pipe Cutting and Threading Machines

Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murphy Machine & Tool Co., Detroit,
Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brant-
ford, Ont.

Pipe and Nipple Threading Machines

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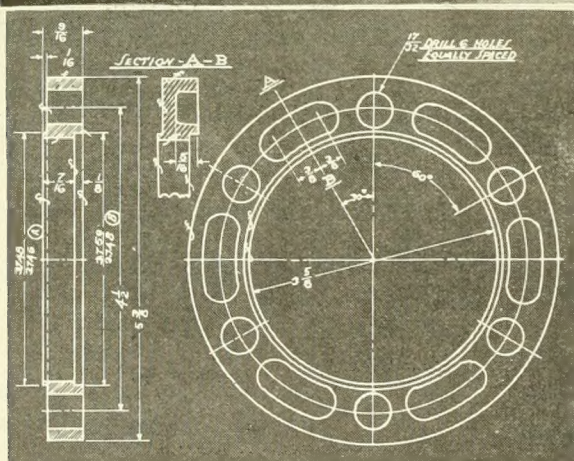
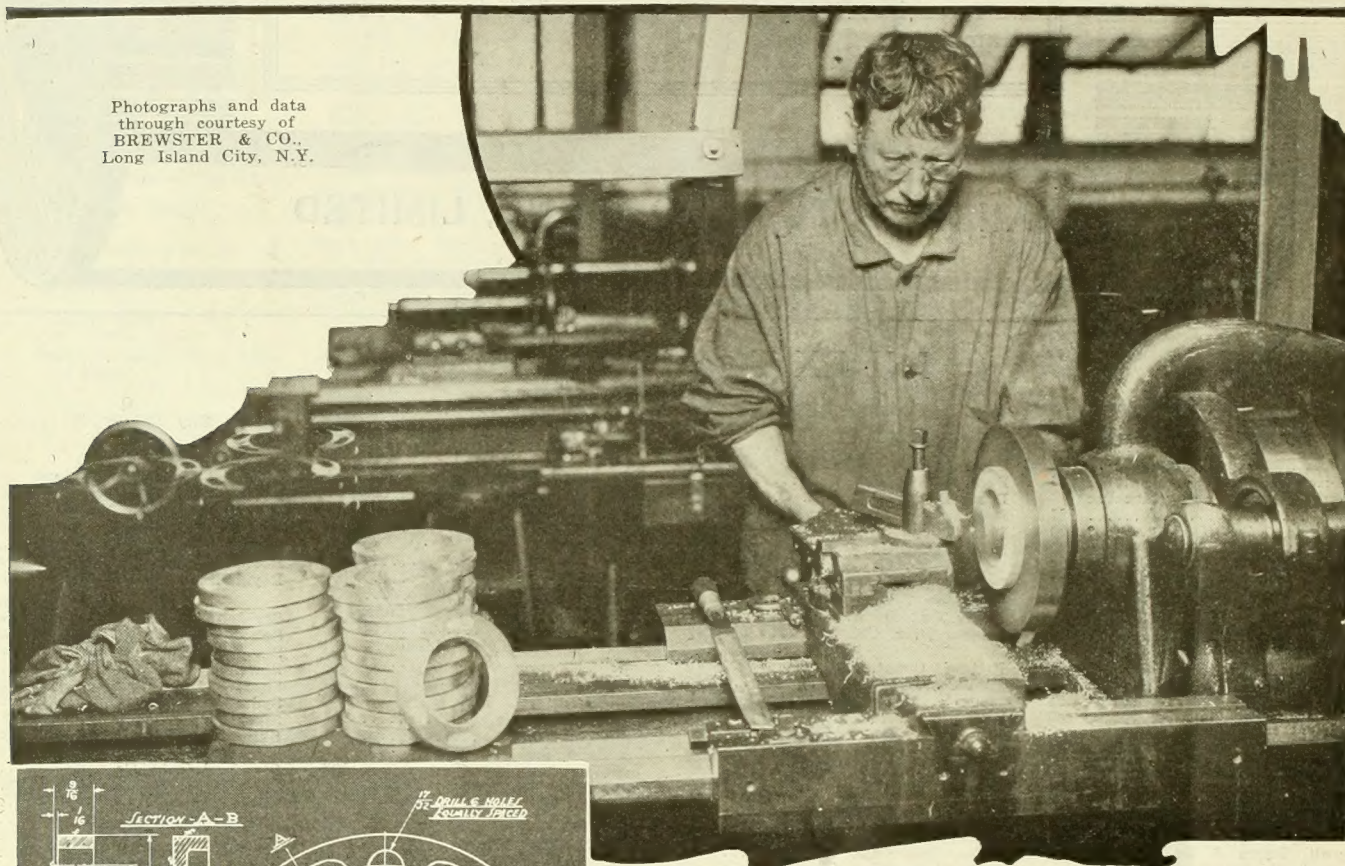
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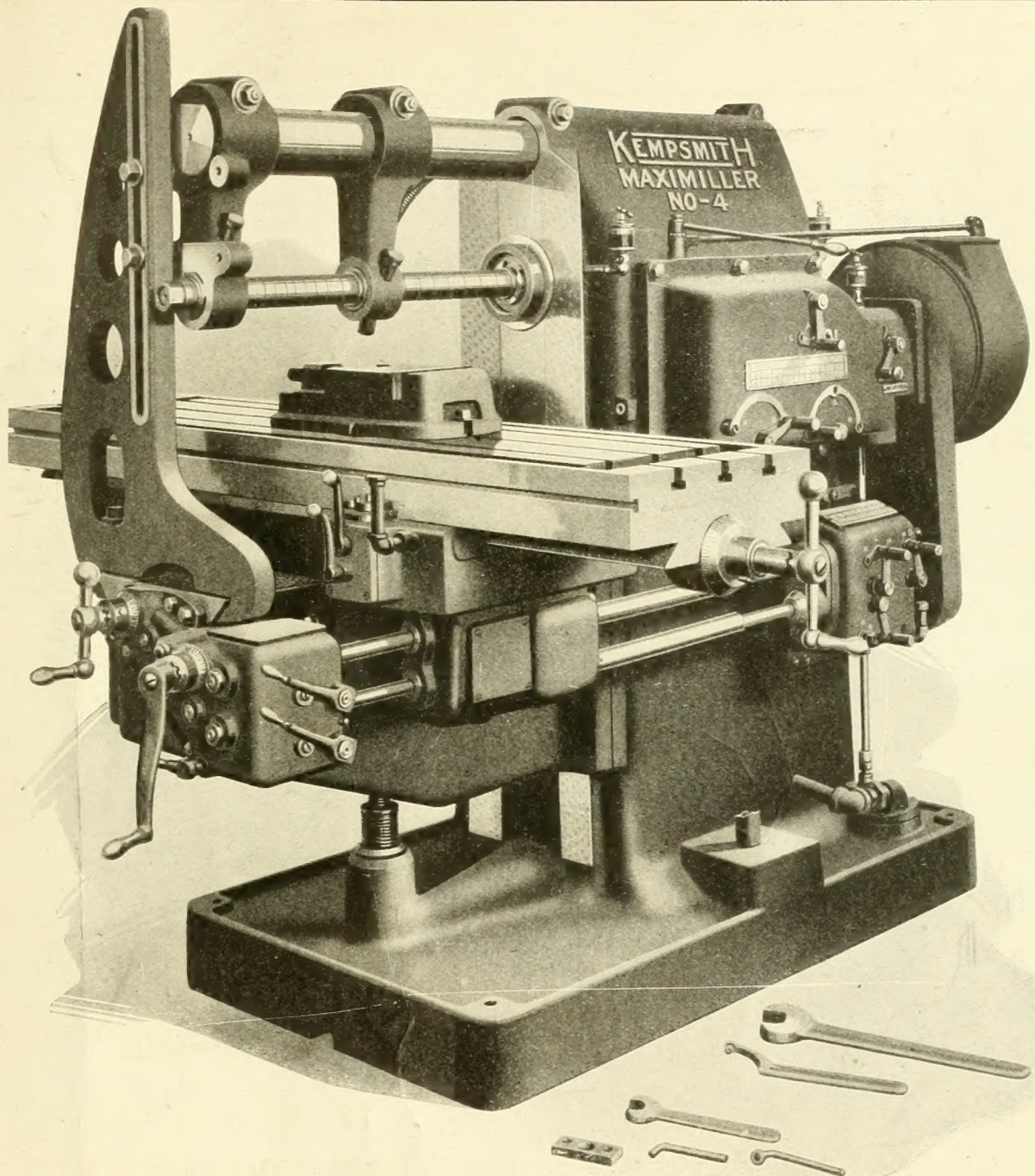
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Archibald & Co., Chas. P.	Dominion Engineering Co.	30	Jones & Lamson	60	Rockford Milling Machine Co.	114	
Armstrong Bros. Tool Co.	Dom. Forge & Stamping Co.	108	Joyce-Koebel Co.	48	Rice Lewis & Son	103	
Atlas Press Co.	Dom. Foundries & Steel Co.		K		Rockwell Co., W. S.	40	
Atkins Co., Ltd., E. C.			Katie Foundry	136	Roelofson Machine & Tool Co.	17	
Atkins Co., Ltd., W.			Kearney & Trecker Co.	21	Royal Bank of Canada	122	
B			Keller Pneumatic Tool Co.	55	S		
Barnes Co., Wallace	Dominion Oxygen Co.	121	Kennedy Co., Wm., & Sons, Ltd.	48	St. Johns, City of	4	
Baird Machine Co.	Dominion Steel Products	99	Kerr & Goodwin Machinery Co.	52	Selson Engineering Co.	23	
Bernard Industrial Co., A.	Drury Co., H. A.	58	Kimber & Hiller Mfg. Co.	98	Sheffield Engineering Co.	125	
Bertram & Sons Co., John	Dunbar Bros. Co., The	109	L		Simonds Mfg. Co.	41	
Bertrams, Ltd.	E		Landis Machine Co.	107	Shuster Co., F. B.	116	
Bilton Machine Tool	Eclipse Counterbore Co.	126	Landis Tool Co.	61	Sydney Machine Co.	128	
Bliss Co., E. W.	Economy Drawing Table Co.	126	La Salle Tool Co.	115	Simonds Canada Saw Co.	41	
Bowser & Co., S. F.	Electric Furnace Construction Co.	128	Lehman Machine Co.	108	Skinner Chuck Co.	52	
Boving Hydraulic & Engineering Co., Ltd.	Co.		Lourie Mfg. Co.	41	Standard Optical Co.	16	
Brantford Oven Rack Co.	Electrical Steel & Engineering, Ltd.	41	M		Standard Tube Co.	137	
Bristol Co.	Electric Steel & Metals	41	MacKinnon Steel Co., Ltd.	54	Starrett Co., L. S.	27	
British Smelting & Refining Co.	Elk Firebrick Co.	7	Madison Mfg. Co.	125	Steele, James, Ltd.	99	
Brown, Boggs & Co.	F		Magnolia Metal Co.	8	Steinle Turret Machine Co.	13	
Brown's Copper & Brass Rolling Mills, Ltd.	Fellows Gear Shaper Co.	38	Manitoba Steel Foundries, Ltd.	124	Stoll Co., D. H.	125	
Brown & Sharpe Co.	Fetherstonhaugh & Co.	98	Mapleleaf Mfg. Co.	6	Strelinger Co., of Can.	110	
Burgess & Marchand	Fisher Motor Co.	10	Marion & Marion	98	Sumner & Co.	117	
Burke Machine Tool Co.	Ford Chain Block Co.	47	McDougall Co., Ltd., R.	61	T		
C	Ford-Smith Machine Co.	10	McKenzie, D., Mach. Co.	128	Tabor Mfg. Co.	117	
Can. Atlas Crucible Steel Co.	Foss Mach. & Supply Co., Geo. F.	Inside back cover	McLaren Belt Co., J. C.	127	Tallman Brass & Metal Co.	115	
Canada Foundries & Forgings	Frost Mfg. Co.	126	Mechanical Engineer's Co.	124	Taylor Co., J. A. M.	126	
Canada Machinery Corporation	Franklin Die Casting Corp.	105	Miller Bros. & Sons, Ltd.	125	Terry & Co., John	49	
Outside back cover	G		Modern Tool Co.	28	Toledo Mach. & Tool Co.	6	
Canada Metal Co.	Galt Machine Screw Co.	22	Morris Crane & Hoist Co., Herbert	90	Toomey, Frank	101	
Canada Wire & Iron Goods Co.	Gardner & Sons	46	Morrow Screw & Nut Co., J.	27	Trahern Pump Co.	58	
Can. Consolidated Rubber Co.	Garlock-Walker Machy. Co.	103	Morse Chain Co.	15	Tube Co. of Canada	60	
Can.-Detroit Twist Drill Co.	Geometric Tool Co.	91	Morse Twist Drill Co.	31	Tullis & Son Ltd., John	55	
Can. Fairbanks-Morse Co., Ltd.	General Combustion Co.	57	Morton Mfg. Co.	5	U		
Can. Desmond-Stephan Mfg. Co., Ltd.	Gisholt Machine Co.	65	Moore & Sons, Thos.	116	Union Drawn Steel Co.	127	
Can. Drawn Steel Co.	Greenfield Tap & Die Corp.	19	N		Union Mfg. Co.	52	
Can. Driver-Harris Co., Ltd.	Guilford & Sons, Ltd.	101	National Acme Co.	53-119	United Alloy Steel Corp.	32	
Can. Graton & Knight	H		Nicholson File Co.	54	Underwood Corp., H. B.	7	
Can. Ingersoll-Rand Co.	Hamilton Engineering Service, Ltd.	98	Northern Crane Works	123	United States Machine Tool Co.	114	
Can. National Carbon Co.	Hamilton Gear Machine Co.	127	Norton, A. O.	125	United States Electrical Tool Co.	115	
Can. Steel Foundries, Ltd.	Hanna & Co., M. A.	46	Norton Co. of Can., Ltd.	64	V		
Can. Winkley Co.	Heald Machine Co.	25	Nova Scotia Steel & Coal Co.	59	Vanadium-Alloys Steel Co.	37	
Carter Welding Co.	Hendey Machine Co.	138	O		Victoria Foundry Co.	124	
Cataract Refining Co.	Henry & Wright Mfg. Co.	117	Oakley Chemical Co.	111	Vulcan Crucible Steel Co.	49	
Cincinnati Elec. Tool Co.	Herbert, Ltd., Alfred	101	Oliver Machinery Co.	31	W		
Classified Opportunities	Hepburn, Ltd., J. T.	40	P		Wabi Iron Works, Ltd.	41	
Clemson Bros., Inc.	Hoefer Mfg. Co.	62	Parmenter & Bulloch Co.	125	Waltham Grinding Wheel Co.	45	
Cleveland Twist Drill Co.	Hiden Co.	120	Perrin Ltd., William	25	Walton Co.	114	
Clipper Belt Lacer Co.	Holly, R. S.	101	Petrie Co., Ltd., H. W.	38	Warner & Swasey Co.	39	
Commercial Camera Co.	Hoyt Metal Co.	47	Philadelphia Gear Works	127	Wheel Truing Tool Co.	125	
Cook, A. S.	Hughes, Owen Co., Ltd.	124	Pillatt & Co.	98	Wilkinson & Kompass	127	
Crane Ltd.	Hull Iron & Steel Foundries, Ltd.	43	Pilot Steel & Tool Co.	55	Williams Machy. Co., A. R.	89	
Crescent Machine Co.	I		Pink, Thomas	47	Williams Co., J. H.	112	
Curtis Pneumatic Machine Co.	Illingsworth Co., John	37	Positive Clutch & Pulley Works	125	Williams Machy. & Supply Co., Ltd.	102	
Cushman Chuck Co.	Independent Pneumatic Tool Co.	109	Pratt & Whitney		Williams Tool Corporation	14	
D	Ingersoll File Co.	105	Inside front cover		Willson Goggles, Inc.	125	
Darling Bros., Ltd.	Ingersoll Machine Co., Ltd.	2	Prest-O-Lite Co.	43	Wisconsin Electric Co.	95	
Davidson Mfg. Co., Ltd., The	International Malleable Iron Co., Ltd.	34	Puro Sanitary Drinking Fountain Co.	98	Y		
Thos.					Yeates Machinery Co.	122	

HENDEY

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KEMPSMITH No. 4 Plain Maximiller

Single Pulley Drive

Equipment.—1 $\frac{3}{4}$ -inch arbor, two arbor supports, brace, No. 4 Plain Vise and all necessary crank-handles, wrenches, and accessories as shown.

The Kemp Smith No. 4 Plain Maximiller has been designed in recognition of the growing demand for a heavier and more powerful machine than the usual cone type miller. It is the product of some twelve years' experimentation by an experienced and thoroughly seasoned organization. In all features of general design, such as weight, rigidity, convenience of operation and efficiency in production we offer this machine as maximum milling machine of similar rating.

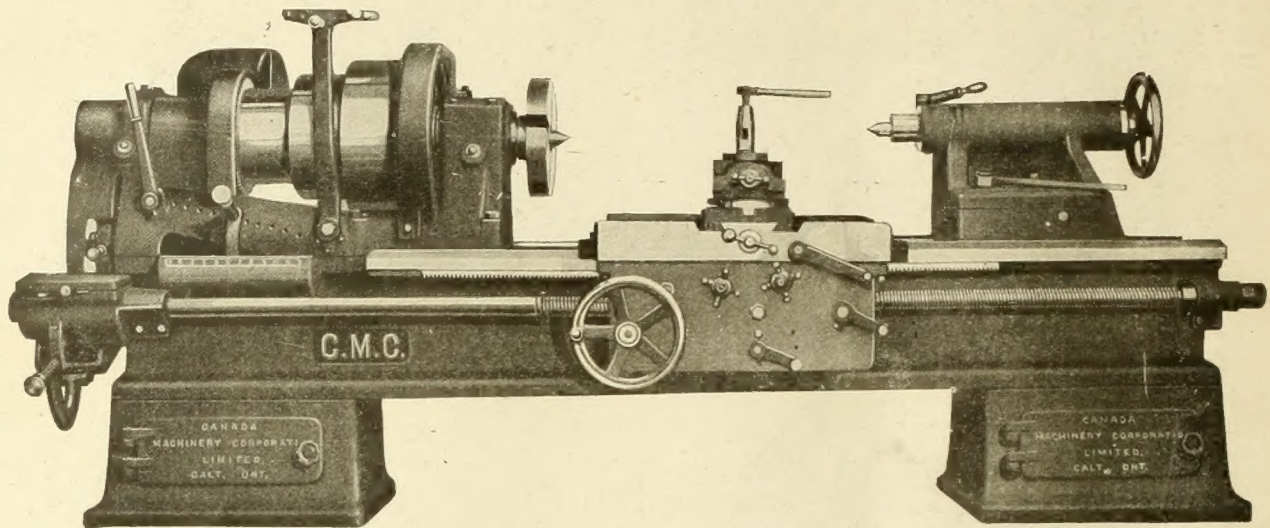
No expense has been spared to incorporate the very highest class of materials obtainable. All gearing stock is purchased to exact chemical analysis and is scientifically heat-treated for the particular use to which it is put. Much of the shafting, especially that in the speed train, is also heat-treated alloy steel.

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Notice the extra wide cones on the headstock. Wide cones mean more power and more power means greater production and larger profits. The special belt shifter placed on the headstock in front of the cones prevents any danger of injury to the operator when changing belts from one step to another, this shifter being fitted with a self-locking pin which centers the belt over each cone as desired. A corresponding shifter on the countershaft completes this safety first attachment.

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